99'er

COVERING THE TEXAS INSTRUMENTS
BRAND OF HOME COMPUTERS

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HOME COMPUTER magazine

March, 1983 $3.50 in U.S.A.

COMPACT COMPUTER 40
TEXAS INSTRUMENTS BASIC COMPUTER 99/2
H.A.

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Personal Computing Goes Compact

The Gravity of LOGO

20 Questions With Robot Redford

Say & Spell on the Home Computer

Program Utilities for the 99/4A

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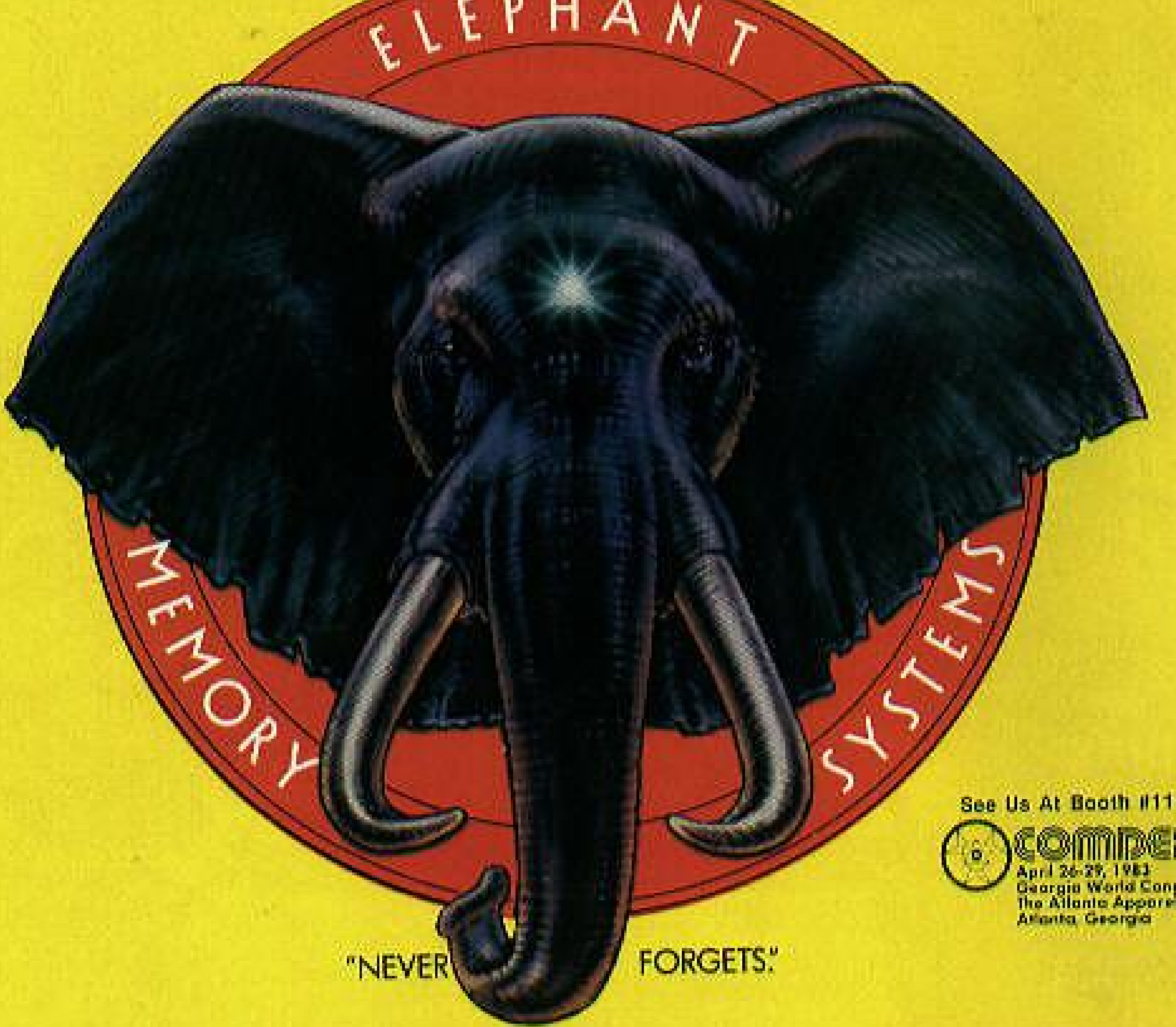

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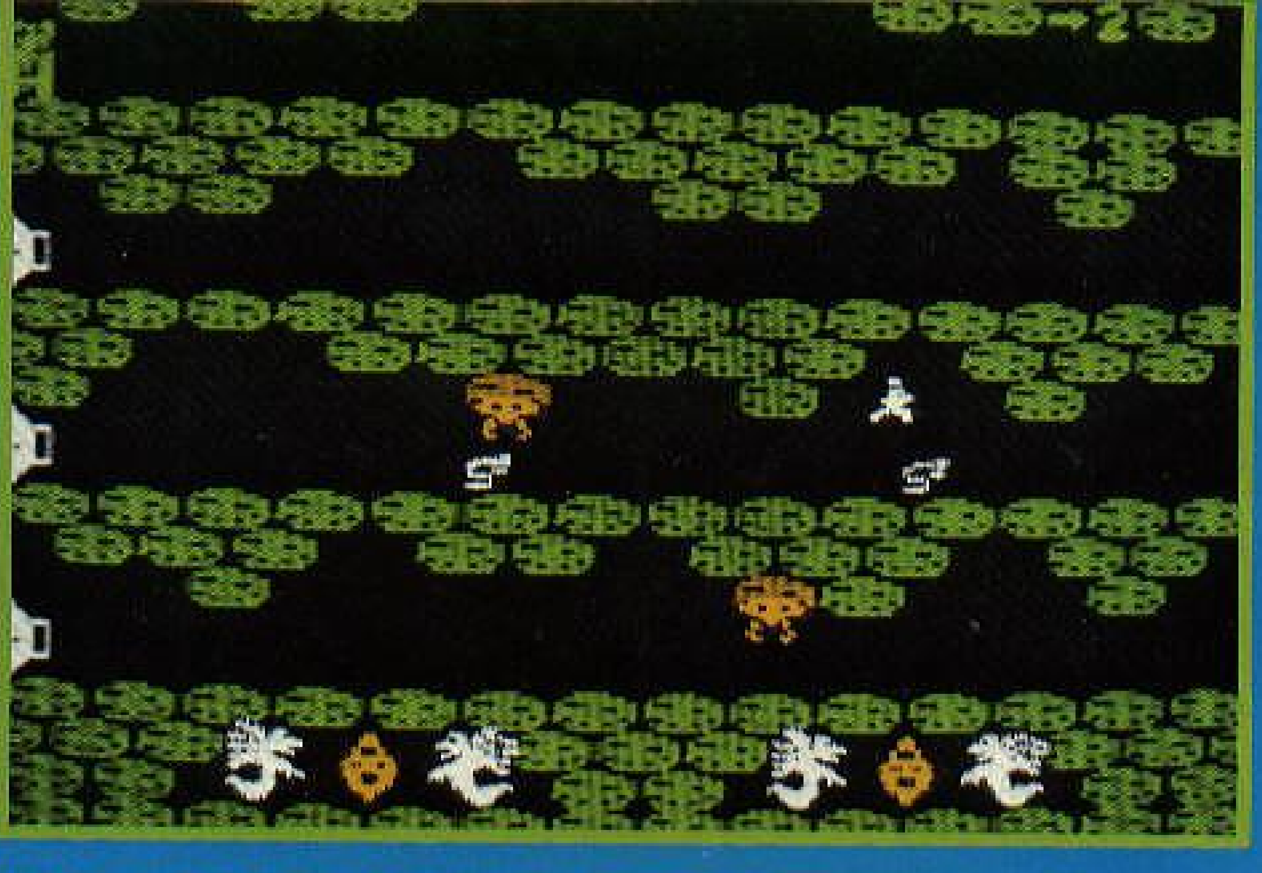

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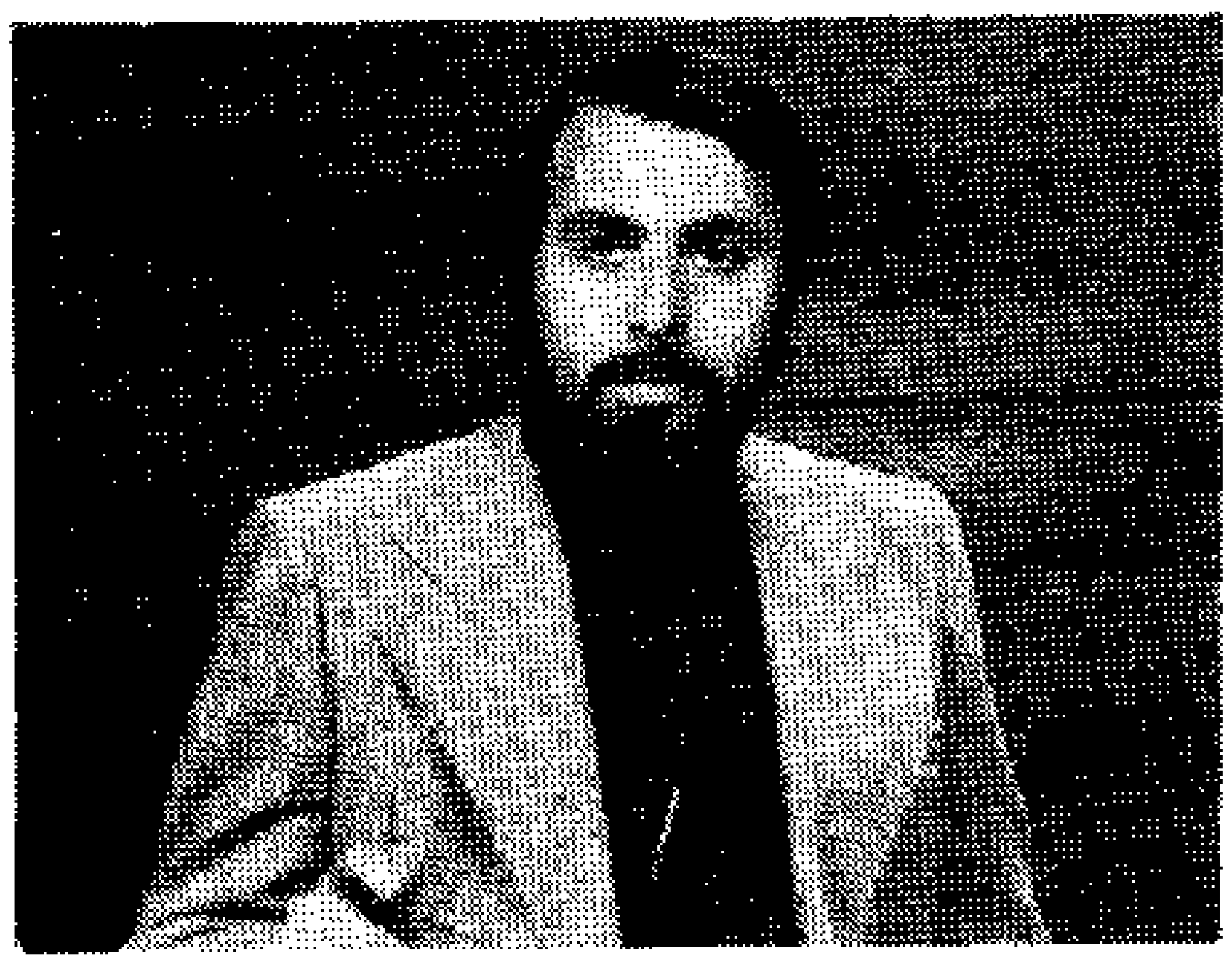
ON SCREEN



By Gary M. Kaplan
Publisher & Editor-in-Chief

> "As we grow in circulation, a larger and larger pool of reader talent and ideas becomes available . . . all of us benefit as this collective wisdom finds its way into the pages of 99'er and drives the state of the art into exciting new domains."

You've probably heard the old saying, "The more things change, the more they remain the same." Well, *99'er Home Computer Magazine* is no exception: In recent issues we've been implementing new features and extending our editorial coverage. While doing this, it often has been necessary to restructure parts of the magazine, and redesign certain sections to enhance its overall appearance, readability, and value to Home Computer users. In the next few months, you'll undoubtedly be witnessing a great deal more of this change as we undergo a metamorphosis in content, packaging, distribution, and promotion in an attempt to make the magazine even more useful and enjoyable to you, and to attract hundreds of thousands of additional newsstand readers to the world of 99'er home computing . . . But please remember, through all this change, we are still the *same* reliable source of information and entertainment—one that you can count on to help you get the most out of your Texas Instruments Home Computer system.

Last month we covered all the excitement of the new products introduced at the Winter Consumer Electronics Show. And starting with this issue, we take the two new TI computer systems and associated peripherals into our editorial fold. It's an exciting prospect for us to bring you this additional coverage. By the way, if any of you have ideas or questions about using the new products in conjunction with the 99/4A Home Computer, please drop us a line.

And don't just limit your letters to the *new* products. We still need your comments, ideas, questions, articles, and programs on and about the 99/4A. For as we grow in circulation, a larger and larger pool of reader talent and ideas becomes available to draw upon. And *all* of us benefit as this collective wisdom finds its way into the pages of 99'er and drives the state of the art into exciting new domains . . .

Nowhere is this trend more obvious than in the vast quantity of third-party software that is sent to our offices for review. The variety and quality of entertainment, educational, utility, and business software on cassette and disk has taken a quantum leap forward in the past couple of months. I strongly recommend that you sample some of the products advertised in this issue. Not only will you (I hope) be pleasantly surprised with the value you receive, but you'll also be encouraging these software producers to offer you more variety and even better products. And if you should happen to stumble upon an unusually good (or bad) product, please let us know, so that we may pass on the information to other readers.

As publisher, I am particularly pleased with this March issue—everything from the cover and contents page design, the wide diversity in articles and features, to the novel (and we hope, more helpful) way of presenting program listings. Speaking of diversity, I should warn you that occasionally you'll be seeing articles on subjects that, at first, *appear* to have no bearing on using your Home Computer. I assure you, however, that this couldn't be farther from the truth. What we're actually doing is preparing you for an exciting new lifestyle to come—one in which your personal computing machine will help you control more of your immediate environment.

Our overview (both serious and humorous) of robotics in this issue is a case in point: Although it might *seem* a little premature to be suggesting that home computers will soon be tied to home robots, let me assure you that it is indeed feasible—and likely to happen within the next 18 months. The highly visible passel of robots that graced January's Consumer Electronics Show signified the "birth" of a consumer robotics industry—robots for the home, school, and office. Crowds of wholesale and retail buyers were fascinated by a little three-foot-high fellow named TOPO who could be controlled (by programming in Forth, LOGO, or BASIC) from a microcomputer via a cable, infrared, or radio link.

Analysts' predictions for numbers of consumer robots run from a low of one-half million units annually by 1990, to a high of five million units. All the forecasts I've seen, however, are based on an average price of $1000—a figure that might possibly prove to be an order of magnitude high by the end of the decade. The robot equation is really a question of how quickly price and utility (e.g., applications for home security, child education, household labor, and some business functions) reach the combined levels necessary to produce volume sales. When affordable hardware does arrive, a new software industry will take off into the stratosphere . . . After all, somebody's got to write the programs to control all these millions of popular robots!

Not too long ago, I asked for your help. In response, you found us new subscribers and dealers to carry this magazine. As a result of this aid, we were able to convert to a monthly publication far ahead of schedule. I'm now going to ask for your help once again. If you can assist us in finding more subscribers and sales outlets for *99'er Home Computer Magazine*, we'll be that much faster in fulfilling our promise: to deliver a "fatter" issue to your door each month—more articles, features, programs, photos, and "compu-prestidigitation" (see *Inside 99'er* in this issue). I know we can achieve this in record time by working together.

And one last favor before I sign off this month: If you haven't already done so, please fill out and return the 99'er Questionnaire bound into the front of the magazine. It doesn't matter if you're a subscriber or not, or even if you own a computer—there are appropriate questions for all. Compiling the data on the questionnaires is extremely important, and yes—it really *can* have quite an impact on the entire Home Computer Revolution!

99'er HOME COMPUTER magazine

Hayder Amir's cover art celebrates the birth of new computers and peripherals from Texas Instruments. In the foreground is the TI-99/2 Basic Computer—a machine destined to blaze a trail through computer illiteracy—carving out its own special niche as the *new* tool of learning. Behind it lies the Compact Computer 40 and the compact peripherals—the first of a series of portable-but-powerful products for business, science, engineering, and other professional uses. Beyond these latest offspring is the well-known TI-99/4A Home Computer and peripherals, the "patriarch" of this family of computers. Glowing in the background, the planet's horizon suggests the dawning of a new age in personal computing.

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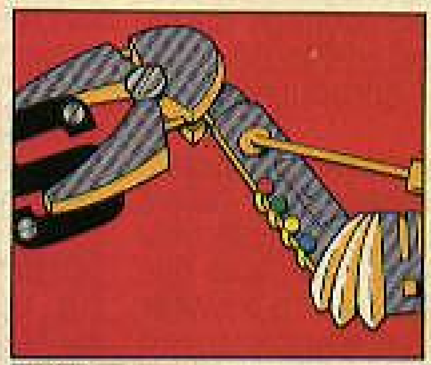

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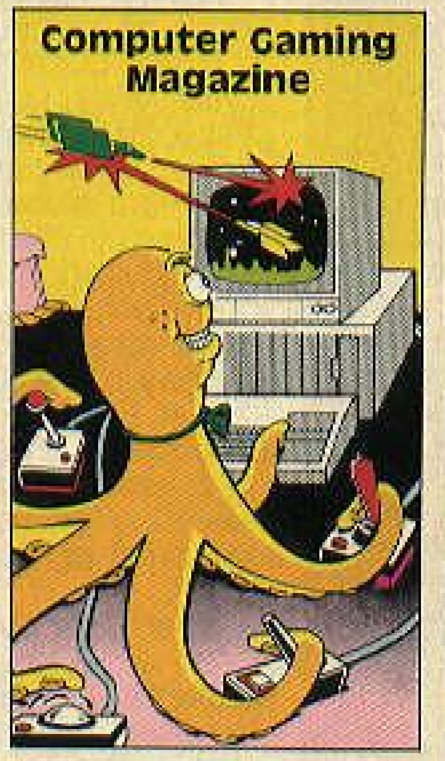

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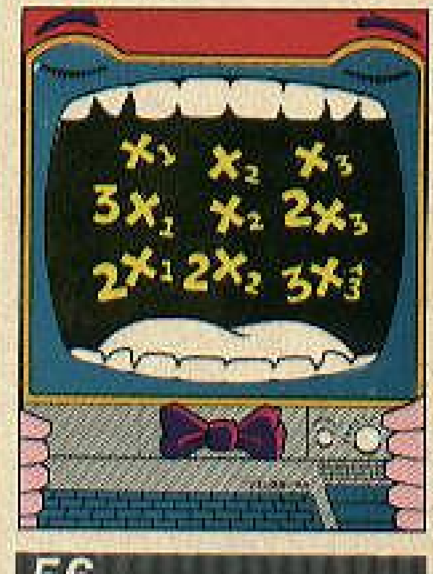

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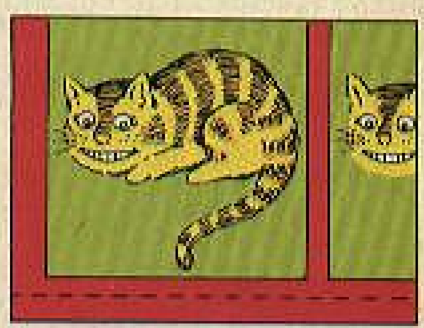

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INSIDE

As spring comes to the Pacific Northwest, we here at *99'er* have traded gray skies for the silver linings of TI's new state-of-the-art small computers and peripherals. Our admittedly enthusiastic coverage of the Basic Computer, Compact Computer, Hex-bus adapter, and compact peripherals starts in this issue.

Also in the queue this month, we look at a humble-but-indispensable peripheral, the joystick. Our *Joystick Jockey* shows that he has been on the stick in covering this gripping topic.

Moving that joystick is what it's all about, of course, so we now cheerfully direct our fire buttons at *Space Junket*, a way-out scenario pitting your spacecraft against a barrage of meteoroids. Coming down to earth, we find *Quintus*, a challenging strategy game, awaiting us. You'll find this to be a fine little invitation to computer-player interaction.

To interact with your machine on a somewhat more complex level, take a look at *Extended BASIC to Assembly Language*. It offers some valuable tips for translating programs into a faster executing form so that you can speed up some of your less-than-exciting games.

Repetitious spelling drills are also often less-than-exciting for eager students. As a remedy, we offer *Say and Spell*, a tutorial using computer voice synthesis. Simple educational programs such as this can be of far greater significance than we might expect. For example, such programs have even transformed the lives of disabled children. See the inspiring article, *Jason and Michelle*, for two case histories.

Even Sir Isaac Newton would have been intrigued by *The Gravity of LOGO*, an exploration into the movements of LOGO sprites. And leaving the shade of that old apple tree, we gravitate to *Pulling the Shade on Sprites*, a short Extended BASIC tutorial that shows how invisible shapes can lurk between the lines of a program.

You don't have to read between the lines of a mathematics text to conclude that algebra equations can be very tedious—unless you can get your hands on a program like *Matrix Muncher*, a new software tool that solves simultaneous equations. We welcome such programs because they keep us from having to solve calculations manually—relieving us of hours of robot-like routine.

The few robots we have had the privilege of meeting were anything but tedious. Robotics is starting to make big news, and we include an overview of their present status in *Robots: New Contender for Man's Best Friend*. The sidebar, *Twenty Questions with Robot Redford*, will not win a prize for scientific accuracy, but may bring a smile to those who have a touch of innocence in their chips. And if your sanity is threatened by the bugs that often show up while you are entering Assembly Language into Mini Memory, you will definitely want to use our *Mini Memory Disassembler Utility* in this issue.

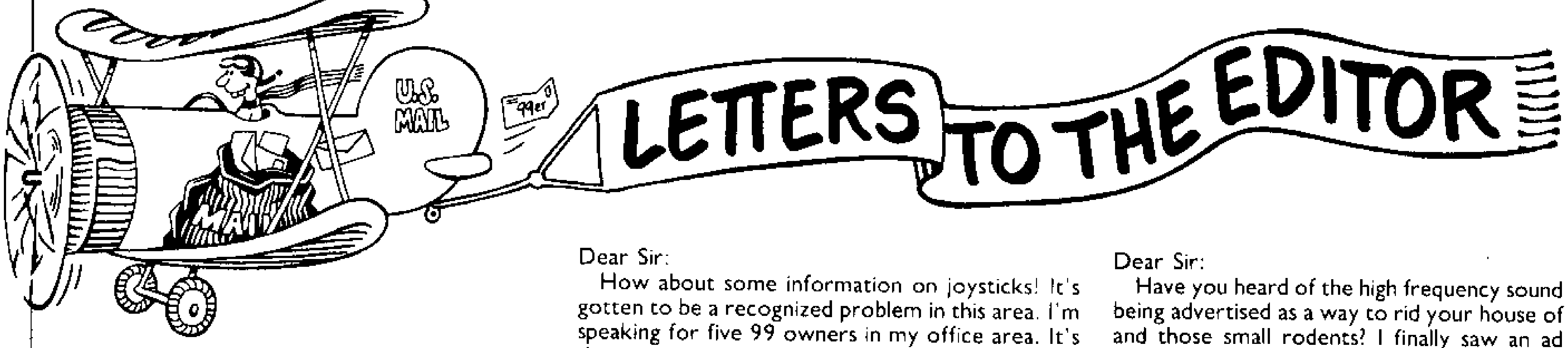
The *Super Cataloger* is a utilitarian program to help you organize your diskettes. Our review tells you about a piece of software that keeps you in touch with all of your files. No more puzzling over which disks are empty or full. But lest we take *all* your puzzles away, you will be pleased to see that we have started *Crossbytes*, a regular feature guaranteed to test your knowledge of computers, programming and related topics.

While looking over the Computer Gaming programs and other software offerings in this issue, you will notice a "new look" to the software listings. Many of the problems readers have had with keyboard entry of the *99'er Home Computer Magazine* programs have been traced to miscounting the spaces in a BASIC statement line. We're sure that the new vertical grid design will prove to be helpful in eliminating this problem.

And helping to round out this March issue—providing our readers with a full measure of education, recreation, information, illumination and compu-prestidigitation*—is a hearty blend of entertainment and utility software, reviews, gaming strategy, informative letters, late-breaking news and much, much more.

Until next month, have fun reading, learning and RUNing!

* **compu-prestidigitation** (kóm′•pū•prĕs′•teh•dĭ′•jeh•tā′•shŭn) *n.* **1.** The magical quality of unexpected comprehension that results from presenting technical information about computers in a lively, entertaining, visually attractive and easy to-understand format. **2.** The magical tricks that make a computer sing, dance, and do all sorts of wonderfully useful things.



LETTERS TO THE EDITOR

Dear Sir:

The first meeting of the Central Jersey TI Users Group was held Jan. 3, 1983 with 28 members. Three TI-99/4A's were demo-ing a variety of programs, and a member-written program handled registration. Being a new group, we would appreciate any help, ideas, or suggestions you or any of your readers could share.

We would be happy to exchange newsletters!

Bill Blader
Central Jersey TI Users Group
200 Atlantic Ave.—Box 286
Manasquan, NJ 08736

OK, all you Central Jersey TI'ers, now you've got a group to join. Thanks, Bill, for the information.

Dear Sir:

First off, let me say that "our" TI-99/4A is my son's, but we both participate and all our friends and neighbors enjoy its use. Without *99'er Magazine* our pleasure would surely be diminished at least 50%! We thoroughly enjoy your great articles, programs, and news of what is new & what's coming at us.

We are a family of six "ham" radio operators, and would sure like to see some articles and/or software to merge the TI-99/4A with our radio station, to run RTTY or send & receive Morse code. We have all the necessary peripheral hardware, but no software. By the way, with new FCC rulings that make ham radio licenses easier to obtain, the present US census of licensed hams (400,000+) is expected to double or triple in the next two years.

Well sir, if you are looking for a new area of interest, this area would sure grab me! Thank you for a great magazine. Our renewal is being mailed today under separate cover—see you next month!

Jack E. Keifer
Portville, NY 14770

Good idea, Jack. Many other amateur radio operators have written asking for articles in this area. We really are interested in publishing quality articles and software—especially if it is aimed at a novice audience.

Dear Sir:

How about some information on joysticks! It's gotten to be a recognized problem in this area. I'm speaking for five 99 owners in my office area. It's the proverbial "fly in the ointment." After spending $70 on joysticks, I'm not eager to spend more as an experiment. What should we buy that will be both responsive and durable?

Your magazine is super! Keep up the good work and make the information in the out-of-print issues available to those of us who got into TI-99 ownership recently.

Bill Collier
Petersburg, Va 23805

Bill, in this issue we have a short piece on the things to look for when buying a joystick, but the one to buy is up to you.

Good news: Most of the articles/programs in the out-of-print issues will re-appear soon in the form of a 350+page book. Our staff is putting on the final editorial touches.

Dear Sir:

Here is a short program I invented using a couple of other programs and a small knowledge of sprites. I find it very hypnotic and tranquil.

```
               EXTENDED BASIC
100 CALL CLEAR
110 CALL SCREEN (2)
120 CALL CHAR (96, "3C7EFFFFFFFF7
    E3C")
130 CALL SPRITE (#1, 96, 16, 70, 70)
140 Z1$ = "0000001000000000"
150 CALL CHAR (128,Z1$)
160 RANDOMIZE
170 FOR ST = 2 TO 28
180 STA$ = INT(RND*256) +1 :: STA2 =
    INT (RND*254) +1
190 CALL SPRITE (#ST, 128, 16, STA1, STA2)
200 NEXT ST
210 FOR ST = 2 to 28
220 X = INT (RND*30) +1
230 CALL MOTION (#1, -1, -1)
240 CALL MOTION (#ST, X, X,) :: NEXT ST
250 GOTO 250
```

Brad Lindsey
Denver, Co 80223

Thanks, Brad, that is nice. For all you new owners of Extended BASIC—try it, you'll like it.

Dear Sir:

Have you heard of the high frequency sound units being advertised as a way to rid your house of bugs and those small rodents? I finally saw an ad that discloses their secret. The frequency range is from 25000 to 65000 Hertz, and their units sweep that range, at 125 db. As you may know, the TI-99/4A is capable of producing sound frequencies up to 44733 Hertz. I have no idea what the db. output would be from the monitor's speaker. The advertisements say positively that dogs, cats, and humans are unaffected by their units. But, that after two weeks or less of steady exposure, bugs and varmints leave the area being saturated with the high frequency sound to find more pleasant accommodations elsewhere. Presumably the neighbors have unwelcome guests in the stealth of the night. You may think it worth a trial, particularly if you prefer to avoid poisons, or have house plants that are being destroyed by plant-eating bugs. The following short program can convert your computer into a BUGCHASER, temporarily:

```
 10 CALL CLEAR
 20 A=25000
 30 B=33000
 40 C=40000
 50 FOR I=0 to 32000
 60 CALL SOUND(3000,A,6,B,6,C,6)
 70 A=INT(A*1.0075)
 80 B=INT(B*1.0075)
 90 C=INT(C*1.0075)
100 IF A>44733 THEN 140
110 IF B>44733 THEN 160
120 IF C>44733 THEN 180
130 GOTO 200
140 A=25000
150 GOTO 100
160 B=25000
170 GOTO 100
180 C=25000
190 GOTO 100
200 PRINT A;B;C
210 NEXT I
```

J.H. Harvey
Spartanburg, SC 29301

Ever hear of a more novel use for a Home Computer than this?! You've certainly given "debugging" a new meaning, J.H.

Continued on p. 26

Entering 99'er Programs

New readers should be aware that within the magazine's pages are found actual computer programs that *you* can put into your Home Computer and enjoy.

Make sure you have any special system components required by the program (i.e., the Speech Synthesizer, Extended BASIC cartridge, etc.). Then, using the console keyboard, you can type the printed magazine listing (character for character, and line by line) into the computer's memory.

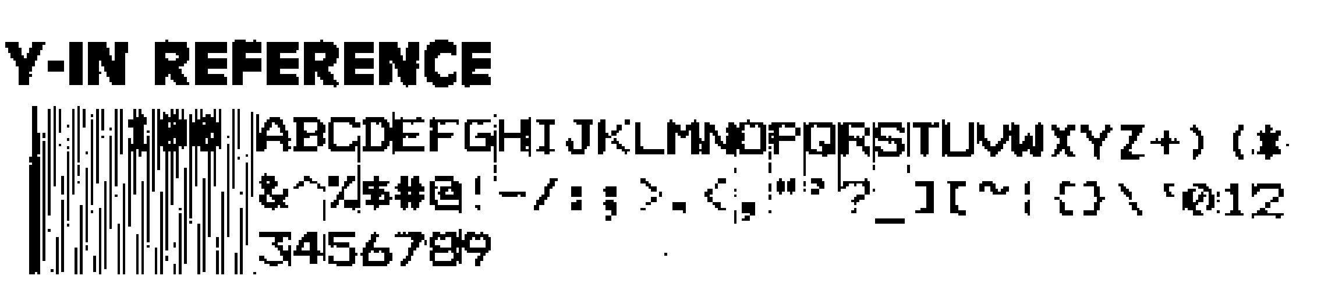
Before entering the program, connect a cassette recorder to the computer. Make sure you have two blank cassette tapes. For each 10-20 lines you type in, use SAVE CS1 to save that program segment onto one of the tapes. Alternate between the two tapes each time you save the program. Be sure to rewind to the beginning of each tape before saving, so that you always record over and replace the shorter segment of program lines with the longer segment. By following this procedure, you'll always retain most of your work even if the lights go out or someone turns off the computer.

Double check your typing against the program listing for errors, and *then* have someone else check it. The most common errors are typing the letter "O" instead of the number "0" (zero)—they are *not* interchangeable to the computer. This is also true for the letters "I" and "L" and number "1" (one). [See "Key-In Reference"]

Every time you make a correction to your program, SAVE CS1 and switch the tapes. Once all the errors are corrected, you will have a good copy of the program on the last tape. Before turning off the computer, put the other cassette tape in your recorder and once again SAVE CS1. Now, if one tape gets damaged, you won't have to enter the program listing via the keyboard all over again. Have fun and happy computing.

Programming Conventions

KEY-IN REFERENCE

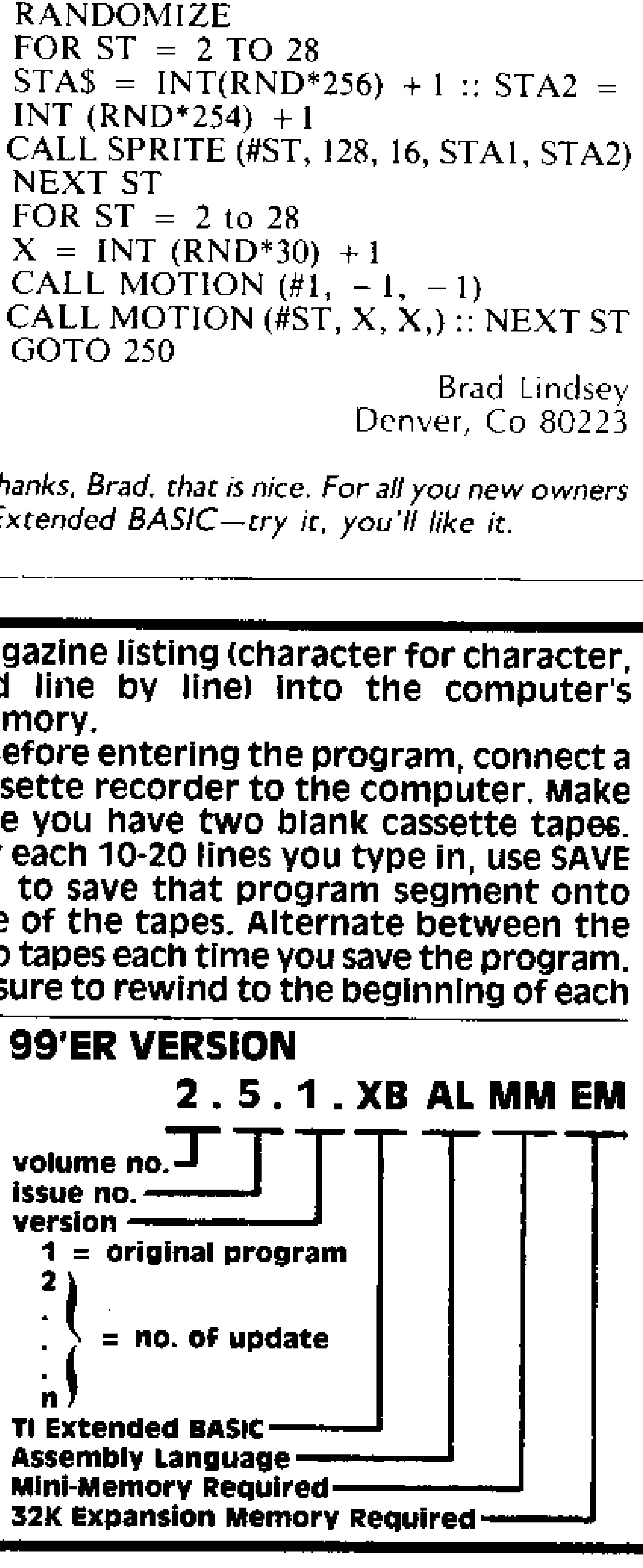


ABCDEFGHIJKLMNOPQRSTUVWXYZ+)(*
&^%$#@!-/:;>.<,"'?_][~|{}\`0 1 2
3456789

=Program as listed will completely fill available memory of TI-99/4A and cannot be RUN with disk controller (and possible RS232 interface) turned on. It must be SAVEd and RUN from cassette. It may also possibly be SAVEd and RUN from disk in Extended BASIC with the 32K memory peripheral if the last 2 character sets were not used.

=End of Program or Article

99'ER VERSION



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To receive your free Speech Synthesizer, complete this coupon, enclose receipt(s) (no photo copies) and the end flaps with the number 1043601-1 from each Command Cartridge box.

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IF YOU HAVE ALREADY ANSWERED OUR QUESTIONNAIRE . . . Please check here ■ and simply return your B.A.R.C. BACK selection.

PLEASE HELP Detach, fold and mail. See other side for instructions. **THANK YOU**

Think of it— The 99'er Questionnaire

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FOR ALL READERS

1. **Are you presently a subscriber?** ☐Yes ☐No
2. **If not, do you intend to become one within the next 3 months?** ☐Yes ☐No
3. **If not a subscriber, where did you get your copy?** ☐Newsstand ☐Supermarket ☐Bookstore ☐Airport ☐Users group ☐Computer store ☐Chain/department store ☐Borrowed from friend ☐Other place
4. **What category of articles do you enjoy the most?** ☐BASIC programming tutorials ☐System tutorials ☐Photo features & news items ☐Game programs ☐Education programs ☐Utility programs ☐Product reviews ☐LOGO articles
5. **How much total time do you spend with each issue?** ☐Less than 2 hours ☐2-4 hours ☐5-7 hours ☐8-10 hours ☐11-13 hours ☐over 14 hours
6. **How many other computer-related magazines do you currently read?** ☐None ☐1 ☐2-4 ☐5 or more
7. **Are you** ☐Male ☐Female ☐Under 16 years of age ☐16-20 ☐21-25 ☐26-30 ☐31-35 ☐36-40 ☐41-50 ☐over 50
8. **Are you a student?** ☐Yes ☐No
9. **What is your annual household income?** ☐Under $5000 ☐$5000-$9999 ☐$10,000-$14,999 ☐$15,000-$19,999 ☐$20,000-$24,999 ☐$25,000-$30,000 ☐over $30,000
10. **What is your ZIP code?** ☐☐☐☐☐

FOR READERS WHO DON'T YET HAVE A TI COMPUTER

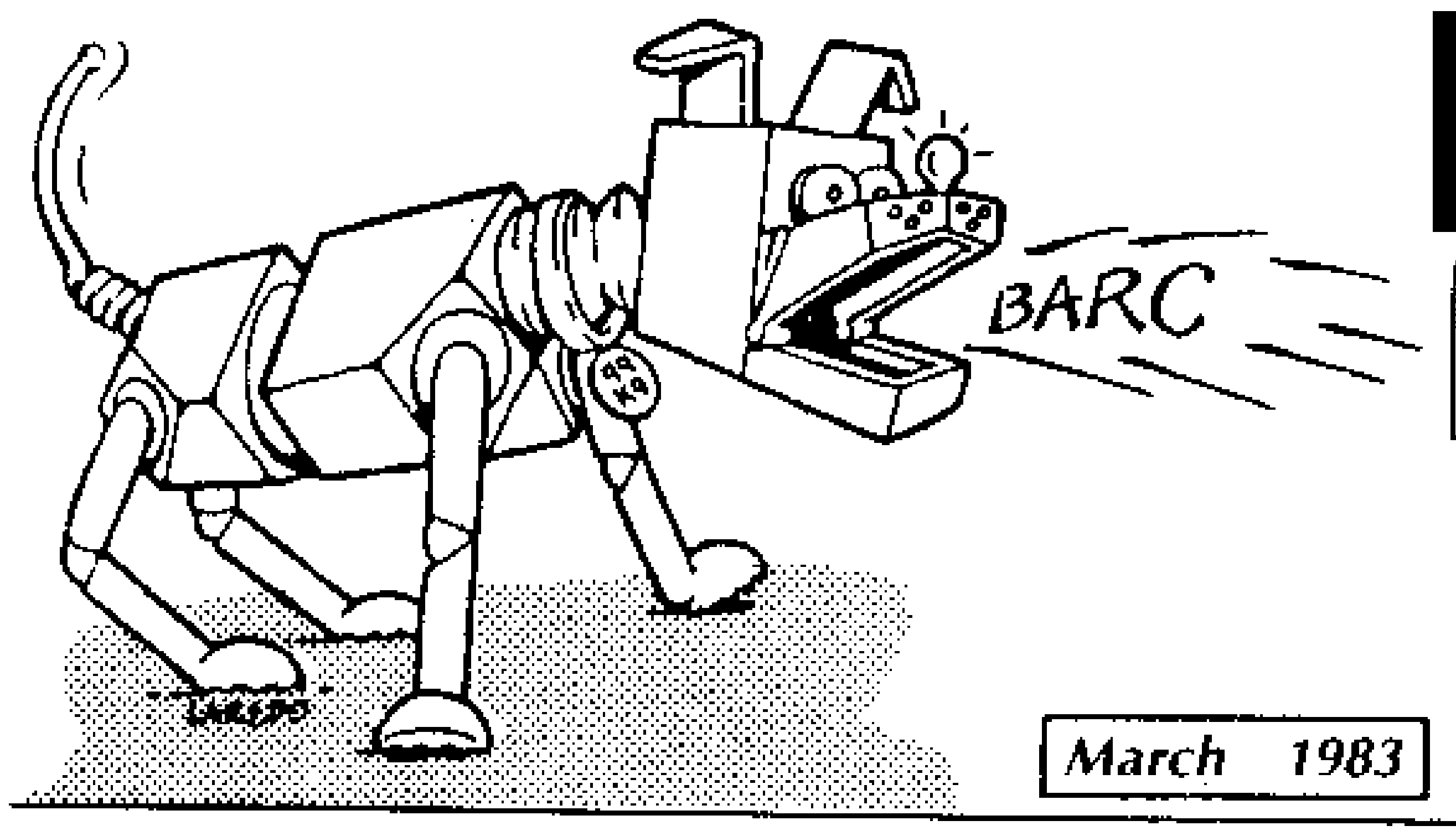
1. **Do you intend to buy a TI computer?** ☐No ☐Yes (within 3 months) ☐Yes (within 3-6 months) ☐Yes (within 6-12 months)
2. **Which do you think you'll purchase?** ☐TI-99/4A Home Computer ☐TI-99/2 Basic Computer ☐Compact Computer 40
3. **What do you anticipate your primary use of a TI computer will be?** ☐Entertainment ☐Education ☐Computer literacy ☐Household management ☐Job-related homework ☐Business ☐Professional use

FOR PRESENT TEXAS INSTRUMENTS COMPUTER USERS

1. **Which system(s) do you currently own?** ☐99/4 ☐99/4A ☐99/2 ☐CC-40
2. **What was your primary reason for buying it?** ☐Entertainment ☐Education ☐ Computer literacy ☐Household management ☐Job-related homework ☐Business ☐Professional use
3. **What was your primary reason for buying the Texas Instruments brand?** ☐Company name/reputation ☐Features for the money ☐16-bit microprocessor ☐Convinced by friends/relatives ☐Ease of use ☐Prior use in course or "Advantage Club"
4. **Which additional TI computer are you likely to purchase within the next 6 months?** ☐None ☐99/4A ☐99/2 ☐CC-40
5. **What peripherals do you currently use?** ☐Cassette recorder ☐Disk controller & drive(s) ☐Peripheral Expansion Box ☐RS232 ☐32K Memory Expansion ☐TV ☐B/W monitor ☐Color Monitor ☐Speech Synthesizer ☐Joysticks ☐Printer ☐Modem ☐p-Code Card ☐Hex-bus Adapter ☐Wafertape Drive
6. **Put a CIRCLE around the above peripheral you are most likely to buy within the next 6 months.**
7. **Mark all TI language software you own or plan to buy within 6 months.** ☐Extended BASIC ☐99/4A Editor/Assembler ☐UCSD Pascal ☐LOGO ☐Forth ☐Mini Memory ☐Pilot ☐CC-40 Editor/Assembler
8. **How much money do you expect to spend within the next 12 months on your computer system?**

Software	☐None	☐less than $30	☐$30-50	☐$51-100	☐$101-250	☐over $250
Peripherals	☐None	☐less than $50	☐$50-100	☐$101-250	☐$251-500	☐over $500
Books	☐None	☐less than $10	☐$10-25	☐$26-50	☐over $50	
Blank tapes & disks	☐None	☐less than $15	☐$15-35	☐$36-75	☐over $75	
Furniture, dust covers, & accessories	☐None	☐less than $25	☐$25-100	☐over $100		

9. **How many software CARTRIDGES do you expect to purchase within the next 12 months?** ☐None ☐1-3 ☐4-7 ☐8-12 ☐over 12
10. **What % of the above CARTRIDGES will be for entertainment?** ☐0% ☐less than 25% ☐25-50% ☐51-75% ☐76-100%
11. **Circle above what % of the CARTRIDGES will be for education.**
12. **Have you purchased from any of our advertisers in the magazine within the last 6 months?** ☐No ☐Yes, Software ☐Yes, Peripherals ☐Yes, Books ☐Yes, Blank tapes & disks ☐Yes, Furniture, dust covers & accessories
13. **About how much money have you spent on the above purchases?** ☐less than $25 ☐$25-50 ☐$51-100 ☐$101-250 ☐$251-500 ☐$501-1000 ☐over $1000
14. **On the average, about how many program listings in each issue do you key into your computer and use?** ☐None ☐1 ☐2 or 3 ☐4 or more



March 1983

B.A.R.C.* BACK

***(Best Article—Reader's Choice)**

Let us know what you like by voting for your favorite article or program in this issue. The winning author will receive a bonus of $100.00

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THE

TI-99/2
Basic Computer

Hex-bus and the 4/A Connection

By David G. Brader

We are currently witnessing a momentous change in the industrialized nations of the world. The economic base is shifting from heavy industry to information processing and computer technology. With this shift, a large segment of our population will need to retrain and become familiar with the new technology. To meet this need, an inexpensive, reliable "computer-literacy tool" will be indispensable.

Most people in the new age will not need to know much about the internal functioning of computing devices—rather, they must learn to *interact* with these machines. How do you "talk" with a computer? Many readers of this magazine are already involved with computer technology in some way, perhaps because of a hobby interest or job-related familiarity. These individuals have already accepted—even welcomed—the challenge of interacting with a computer, and are well on their way into the new age.

The majority of our population, however, is just now starting to accept its fate, and is looking for ways to "come up to speed" by becoming computer literate. Evening classes at local community colleges, mail order courses, and training offered through computer clubs are seeing record attendances. This hunger for knowledge about computers is also demonstrated by the high-volume sales of the Timex-Sinclair 1000 computer, priced under $100.

Timex-Sinclair Had the Right Idea... But TI Has Made It Better

Unfortunately, the Timex-Sinclair 1000 was slightly off target from major market needs. Because the original version could be purchased in kit form, it was a good buy for those few who wished to learn a little about the internal workings of a computer. But for the majority, who simply wished to learn how to get along with a computer, this machine has had many drawbacks: a flat membrane keyboard, 2K-byte memory, low-quality TV display, slow speed, and a general lack of friendliness.

The TI-99/2 Basic Computer and the Timex machine actually have very little in common except price range, black and white display, and approximate size; the TI-99/2 really is in a much higher class with its 16-bit high-speed processor, 4.2K-bytes of memory, and keyboard usable by touch typists. Another notable difference from the Timex machine is that the TV display does not have that headache-producing flicker . . .

For all its superior quality and reliability, the TI-99/2's most significant contribution to computer literacy lies not in the machine itself, but in the first batch of software programs available on cassette tape and on two optional Solid State Software cartridges that have been designed especially for the 99/2. (Plug-in software cartridges are not offered for the Timex-Sinclair 1000. . .) The cassette tape supplied with the Basic Computer gives a short introduction to the machine for the new owner. The two Command Cartridges are available for a suggested retail price of $19.95 each. The first, tentatively entitled *Introduction to Programming*, plugs right into the back of the 99/2 and immediately turns the machine into an interactive teacher showing you how to communicate with it! You don't even have to open the User's Guide to learn.

Cyberphobia Cured

As soon as the new computer owner overcomes *cyberphobia* (fear of computers), there comes a feeling of new confidence and power. It is at this stage that most people will wish further knowledge about the use of computers. For those who would like to start learning to program in BASIC, the second new cartridge, *Learn BASIC Programming*, is the answer. It turns the Basic Computer into a BASIC language interactive teaching tool.

The 99/2 Basic Computer and its first two Command Cartridges are going to make a big dent in computer illiteracy, but when new owners complete the courses and become conversant with the computer, then what? Can the Basic Computer be used for anything meaningful, or will it end up in a hall closet with other electronic toys and games? The answer lies with the owner. Some will be so "turned on" by their new knowledge, they will decide to buy a more feature-laden computer like the TI-99/4A with color, sound, and graphics capabilities. Others will discover the 99/2 to be an extremely fast (with its TMS9995 microprocessor operating at 10.7 Mhz) "pure" computer—with the efficient BASIC (a

Continued on p. 12

YOU'D BE AMAZED.

If you own a TI 99/4A, you're already geared for a business of your own. A business with virtually untapped potential... a business that will profit in direct proportion to the home and business computer boom...a business that will give you the freedom of working and succeeding on your own terms.

Scotch Marketing is the multi-level marketing plan for computer software and related products. Already, Scotch Marketing dealers in all 50 states are building businesses of their own with the help of a comprehensive marketing tool we call SSS—Scotch Success System.

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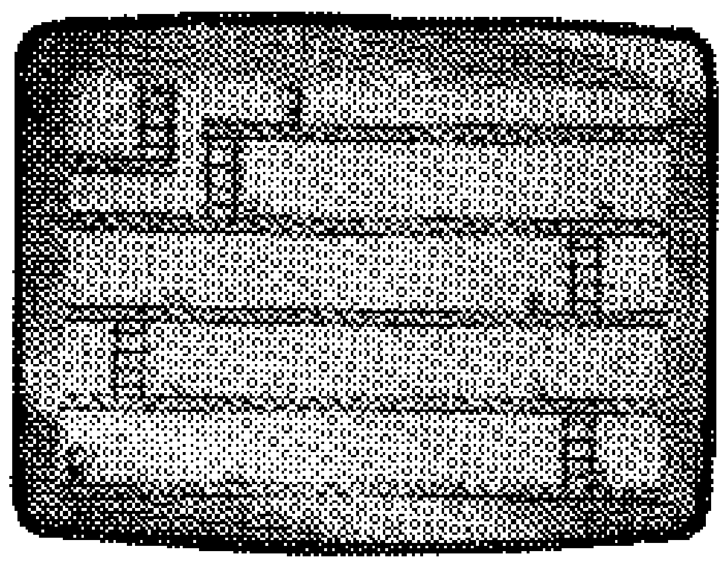
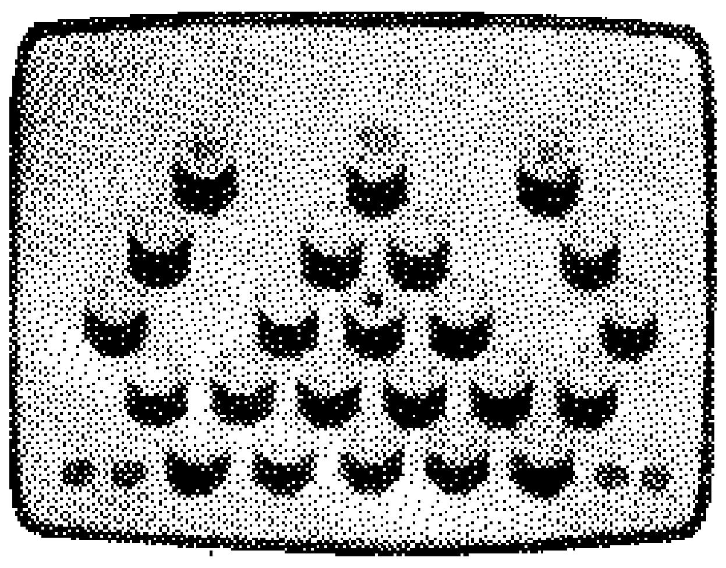
SOFTWARE FOR THE 99/4(A)

GAMES PAK/III



KONG

Help KONG fight his way to the top of the warehouse, avoiding rolling barrels and trap-doors, to save Roxanne from the bomb set in motion toward her by the villainous Igor. Six different screens. Action from all directions. Joysticks required.
Cassette or Diskette $15.00



BOUNCER

BOUNCER bounds from one trampoline to another, scoring points for clearing off the squares. He must avoid the arrows which will burst him. Six different screens, each more difficult than the last. Uniquely coordinated sprites, graphics and sounds make BOUNCER so like a real arcade game, you will wonder why we did't provide a slot for the quarters. Joysticks required.
Cassette or Diskette $15.00

ROMEO

ROMEO has a goal. But he must traverse the blazing desert dunes, swim a stream infested with alligators and sharks, and bolt through treacherous terrain for his just reward. This is enough action to wear out a good set of joysticks!
Cassette or Diskette $15.00

GAMES PAK/II

ARTILLERY

The opposing force must be destroyed by determining angle and force of each shot. An ever changing wind complicates matters. Play is between two players or one player against the computer. Simulates actual ballistic trajectories.
Cassette or Diskette $9.95

DE-CYPHER

An encrypted message is displayed and guesses change all corresponding letters to the guess. Includes a help feature. Comes with 50 messages which can be changed or more can be added.
Cassette or Diskette $9.95

PUZZLE 15

Move alphabetic squares (A to O) into the single empty slot in an effort to arrange them into order. The computer keeps track of the number of moves taken to solve the puzzle and scores of previous games are displayed for comparison. Multiple squares may be moved when appropriate.
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FLIP CHECKERS

Outsmart the computer or an opponent by getting all checkers flipped to your color. Computer determines its moves pleasingly fast. A board game with no pieces to lose. Joysticks required.
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GAMES PAK/I

FROGGY

Jump FROGGY across 10 lanes of traffic then across 6 logs; keyboard or joysticks. Fabulous sprite action!

Works Like A Real Arcade Game

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EXTENDED BASEBALL

Joystick control of the pitcher and the batter, and individual batting averages that specifically effect the batting algorithm. Multi-base and multi-runner plays. Joysticks required.
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GORFIA PESTULITIS

Joystick control of a laser sight or inertia influenced space mines to shoot down the invading Gorfians. Joysticks required.
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DATA BASE for: *Mail Lists, Labels, Files*

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Prompts: user designated prompts.

Complete *File Sort*: 250 records in *100 Seconds*.

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Cassette $32.00 Diskette $35.00

*Should you decide to up-grade to the TI-WRITER module, TYPWRITER and NAME-IT data can be converted for use by that module. NAME-IT alone, will generate 250 TI-WRITER form letter records.

TI-WRITER is copyrighted software of Texas Instr.

SCREEN/DUMP

Print the screen on a dot-matrix printer. Does not require extra memory! Disk version is simple to use. Cassette version requires mild programming knowledge.
Cassette or Diskette $12.00

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List on screen or a printer in alphabetical order by program name or disk name.
Diskette (only) $15.00

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GAMES PAK/II (Artillery, De-Cypher, Puzzle 15, Flip Checkers)	$26.95	(C or D)	$
GAMES PAK/III (Kong, Bouncer, Romeo)	$26.95	(C or D)	$
TYPWRITER (word processor)	$32.00	(C price)	$
	$35.00	(D price)	$
NAME-IT (data base/mail list)	$32.00	(C price)	
	$35.00	(D price)	$
SCREEN/DUMP (printer required)	$12.00	(C or D)	$
MASTER CATALOG	$15.00	(D only)	$

INDIVIDUAL GAMES: (C or D)

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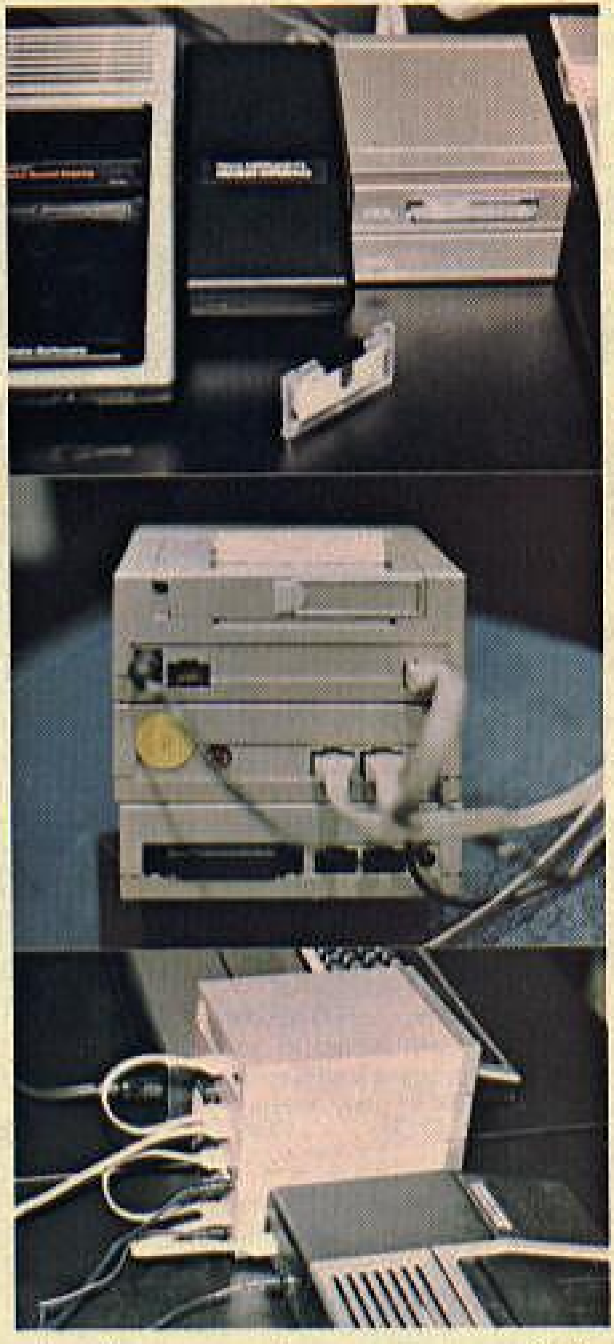
TI-99/2 . . .from p.9

subset of the 99/4A's built-in BASIC) useful for solving engineering problems, science lab mathematics, or record keeping. The latter type of user may eventually desire more capabilities and so will want to expand the system.

There are several ways to expand the 99/2 system. You will be able to attach a shallow cradle to the bottom of the unit to add 16K-bytes or 32K-bytes of user RAM (for a total up to 36.2K); cartridges will soon be available for a great variety of programs and uses; and an eight-pin connector on the rear panel of the machine allows connection to members of TI's new Hex-bus family.



Another very important use of the 99/2—to be explored in greater depth when TI formally introduces its Hex-bus compatible modem—is telecommunications. For perhaps an extra $100.00, you will be able to make use of telecommunications networks such as The Source or Dow-Jones, and even "talk" with a large university library data base or members of a TI users group in your home town or across the country!

99'er Home Computer Magazine welcomes and applauds this new little "99'er," and enthusiastically plans to offer its users the same quality magazine coverage and support which 99/4A owners continue to enjoy.

The Hex-bus Stops Here Too. . .

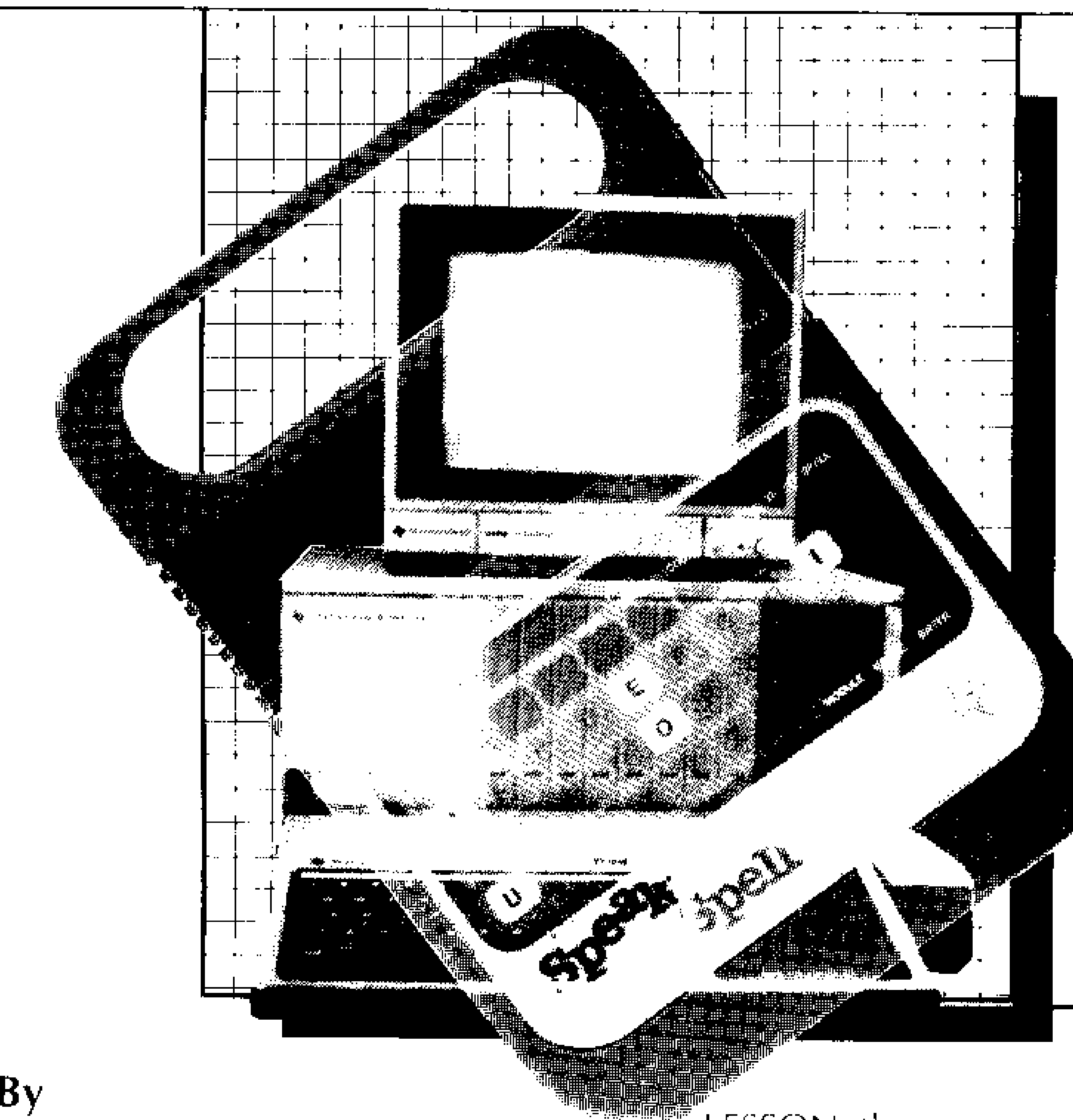
Just because you have already purchased the 99/4A Home Computer doesn't mean that you have missed the bus! With the addition of an inexpensive Hex-bus Adapter TI PHP1300 (suggested retail price $59.95), your *big brother* computer can use the new Hex-bus from Texas Instruments. This new peripheral docks to the right side of the 99/4A and allows the 99/4 Peripheral Expansion System to dock to *its* right side. What does this mean to you? That depends on your interests and needs. If desk space is at a premium, and more expensive higher-performance peripherals (such as disk drives, p-Code, and expansion memory boards) are not needed, the Hex-bus Adapter and its lower performance compact peripherals may be the right choice for you. Currently available are a 4-color printer/plotter, RS232 interface and Wafertape storage device.

Because the 99/2 and the 99/4A can talk to the same peripherals over the Hex-bus, their data and program files can be interchanged via the new Wafertape peripheral media. And programmers who own complete 99/4A systems, including the Editor/Assembler package, can now use the Hex-bus Adapter and Wafertape peripheral to produce Assembly Language programs for the 99/2. We predict that you will soon see some very impressive programming for the new Basic Computer. And should it turn out that the two brother computers can talk to each other directly over the Hex-bus, it might be possible to "download" the 99/2 from the Home Computer.

The Hex-bus itself is nothing more than a set of electrical signals, the specification of a certain connector, and the establishment of a data transfer protocol. The bus has eight wires or signal paths. One wire is not defined for use at this time (it will be used for future bus expansion), and a second is simply connected to ground. That leaves six wires (probably the reason for the "hex" in the name) to be defined for carrying electrical signals between devices that are connected together via the "bus."

Of the six active wires in the Hex-bus, four carry *parallel data bits* and two are used for *handshaking* (to regulate the flow of the data bits). Each device that can be attached to the bus has a keyed *recessed-male* connector while the interconnect Hex-bus cables have matching keyed *female* connectors on both ends. The photo shows some of the compact peripherals connected at their backs with Hex-bus cables.

The 99/2 will play a supporting role in combating computer illiteracy in this age of the new technology. Equipped with introductory Command Cartridges, the system will allow even the greenest users to operate the machine immediately while they learn of its workings. And with the Hex-bus adapter, 99/4 owners can take advantage of the new peripherals designed for the 99/2. Wafertape storage, RS232 interface, 4-color printer/plotter, Hex-bus Adapter, Software Command Cartridges—the possibilities are limitless and the price is right. A new chapter in the story of a new technological age has begun.



Say AND Spell

FOR THE

TI-99/4A

By
David J. Brzuchalski
1600 N.W. 67 Terrace
Kansas City, MO 64118

In the movie *E.T.*, the Extraterrestrial was fascinated with the TI *Speak and Spell*. Well, I too was so taken with the little gizmo that I set out to teach *my* favorite "toy"—the TI-99/4A—to imitate the thing.

The first step in developing my *Say and Spell* program was to group the spelling words into four levels of difficulty. To keep things simple, I selected words already contained in the TI Speech Synthesizer's resident vocabulary.

I decided it would be easier to capture a child's attention if the letters displayed were larger than those in TI Extended BASIC, and that a little color wouldn't hurt matters either. A simple solution popped into my head: convert letters to "ASCII" code, call a sprite for each, define each sprite with the code, then enlarge them with the CALL MAGNIFY function. This I considered quite clever until I found out that Extended BASIC allows a maximum of only four sprites on any one row at a time. [See related article *Pulling the Shades on Sprites* in this issue—Ed.] Hence the need to sit down with pencil and graph paper and define each letter in large size. (However, the sprite technique is still used in the TO LEARN LETTERS mode of this *Say and Spell* program.)

After several hours of shading hundreds of little squares, and getting quite familiar with the hexadecimal code used in the CALL CHAR routine, I completed the program.

A Four-Mode Program

The program opens with a four-option menu screen; the first mode, TO LEARN LETTERS, simply displays and speaks the letter of the key pressed on the keyboard. In the second mode, FOR A SPELLING LESSON, the computer offers a choice of four levels of words, each progressively more difficult, then chooses ten words on the level selected. The program pronounces each of the letters as they appear on the screen, then speaks the word. Next, it is the child's turn to spell for the computer. The speller gets two chances, but the *first* try must be right in order to score. If the spelling is wrong both times, the computer gives the correct spelling; otherwise it will go on to the next word.

The third mode is like the second, except that the words are not displayed first. The computer goes right into the FOR A SPELLING TEST routine after the level of difficulty is chosen and the ten words are selected by the computer.

In the second and third modes, words are spelled by pressing the appropriate letter keys, then pressing ENTER after all the letters are displayed. To return to the main menu, press 9 (BACK without the FCTN key). Note that the ALPHA LOCK key must be down. If you want to hear the word again, press the space bar. After the player has attempted all ten words, the computer shows the score, then offers a choice of starting over, re-spelling the same ten words, or ending.

The fourth option, MYSTERY WORD GAME, is a word puzzle similar to hangman.The screen displays a line for each letter of a randomly-selected word, and it is up to the player to spell out the Mystery Word. The number of wrong guesses is equal to the length of the word. If a clue is desired, press the space bar, but keep in mind that each free letter counts as two wrong guesses. If you should run out of guesses the computer will spell out the word and say it.

Program Modification

There are many ways to modify this program. These are a few easy changes my daughter and I came up with:

1) To allow only one misspelling in spell modes, change Line 1390 to read:

```
  W=W+1::GOTO 1430
```

2) To allow an infinite number of misspellings in spell modes (thus requiring correct entry before play can continue), change Line 1430 to read:

```
  CALL SAY("THAT IS IN CORRECT, TRY
  AGAIN")::GOSUB 1250::GOTO 1420
```

3) To change the number of wrong guesses allowed in MYSTERY WORD GAME:
The phrase . . . IF W>W1 THEN 2000 . . . found in line 1980 sets anything less than the value of the variable W1 as allowable wrong guesses. Change the variable W1 to any numerical value i.e., . . . IF W>7 THEN 2000 ELSE . . .

EXPLANATION OF THE PROGRAM
Say and Spell

Line Nos.	
160-190	Initialize arrays, and display title screen.
200-250	Display main menu.
260-290	Input menu selection and branch to appropriate subroutine.
300-340	Display level of difficulty for spelling lesson, and spelling test.
350-430	Select 10 random words.
440-480	Control loop for displaying and spelling 10 words.
490-1010	Data containing the graphics patterns for the large alphabet.
1020-1220	Assign character patterns, and display letters.
1230-1320	Speak the word to be spelled, and input answer.
1330-1450	Check spelling and give the appropriate response.
1460-1490	Give the final score message.

Continued on p. 17

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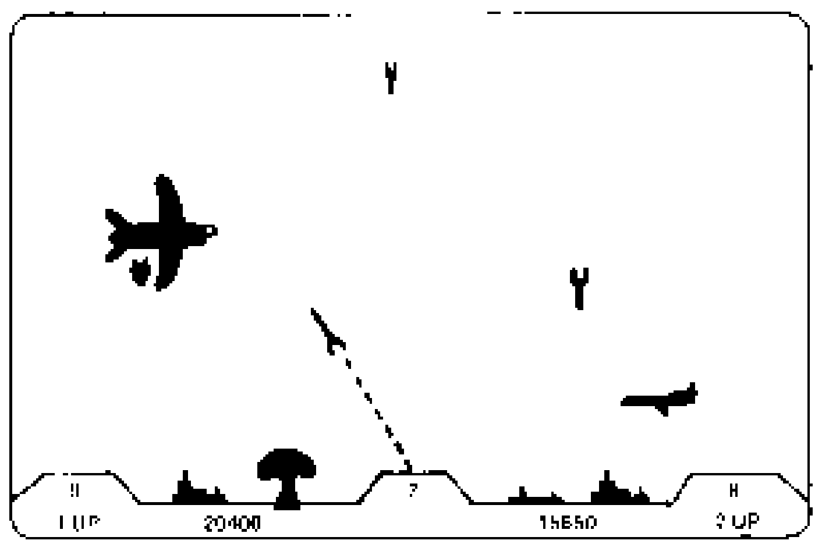
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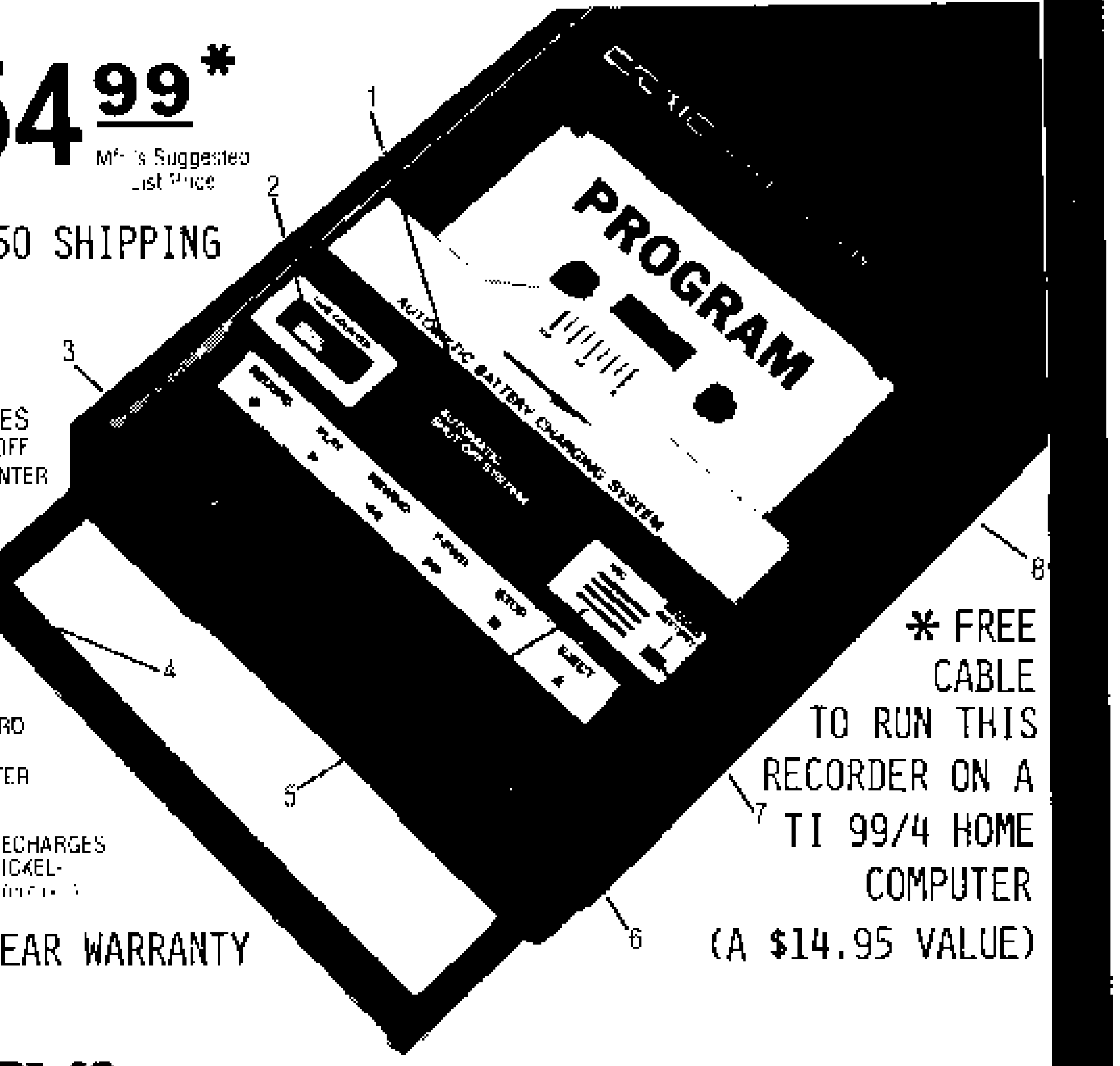
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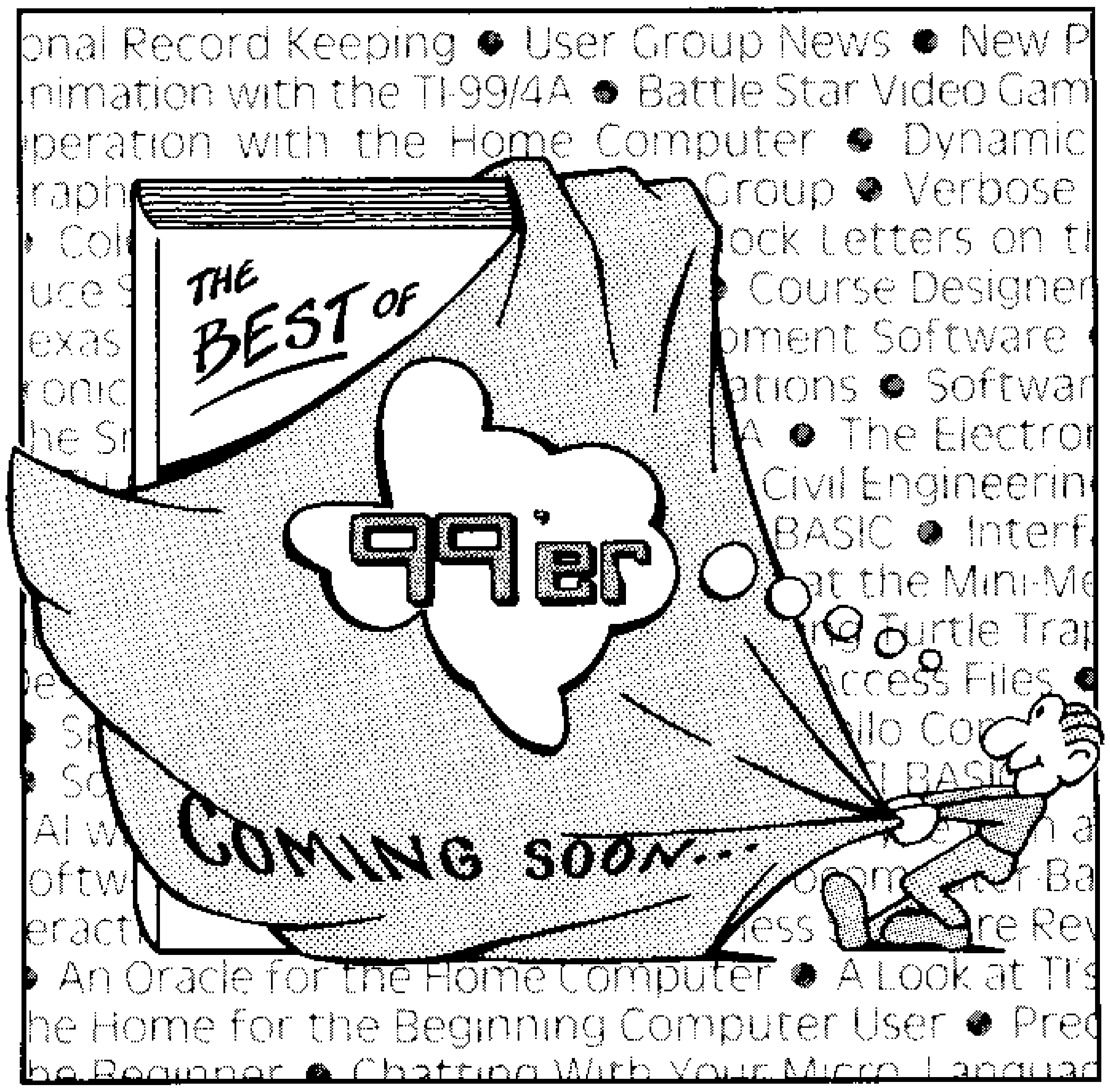
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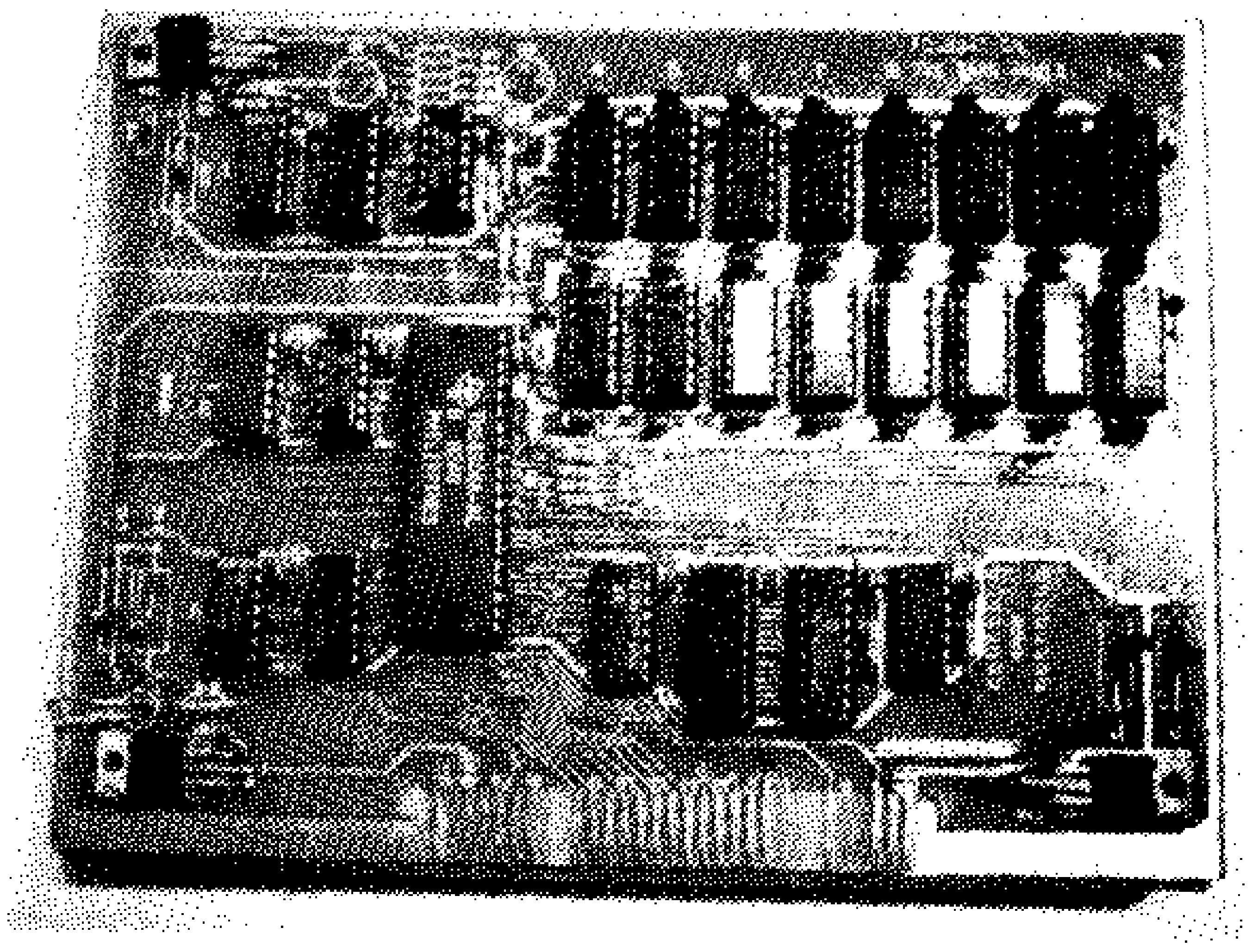

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Jason and Michelle

By Mark R. Sturges

131 Belle View Drive
Petaluma, CA 94952

"For children wit
mental or physica
handicaps, the compute
can provide a creativ
outlet that wi
challenge the
as they develop.

"This is the computer and these are the command cartridges. The command cartridges tell the computer what to do."

"And what's this box, Jason?"

"That's the disk drive."

"What does it do?"

He looks puzzled, and then I realize he is amazed at someone asking such a ridiculous question.

"That's where you keep your programs."

Typical "computerese," right? It is. Sounds like a conversation between a computer programmer and some neophyte, doesn't it? Right again. So what's the big deal? The big deal is Jason, a 13-year- old boy who is mentally retarded with Downs Syndrome. Jason doesn't just play some fairly advanced games. He can *program* a computer. I work in the computer industry, and I saw him do it. Let me tell you, it was a moving experience.

About the Author

Mark Sturges, a resident of Petaluma, California, manages large corporate accounts for Texas Instruments in San Francisco. Having a 3½-year-old Downs Syndrome daughter, a wife who is an occupational therapist specializing in pediatrics, and a strong working background in computers, he is especially committed to finding computer applications that can provide new opportunities for the disabled.

Intellectually Plateaued?

Jason Fesler of Mill Valley, California, shares his computer with his two brothers, Chris and Eric. Jason's mother, Mary, has quietly become a pioneer in the use of Home Computers for educating the mentally handicapped. She has impeccable qualifications, as a former grammar school teacher hired by Texas Instruments to promote their Home Computer in the school districts. She also has managed their downtown San Francisco retail store.

At about the time the state's "experts" told Mary that Jason had "plateaued" intellectually, she brought home a TI 99/4 computer, both for her own use and to see if the children would find it interesting. Eric and Chris immediately took interest, and quite unexpectedly Jason also became fascinated, particularly with the colorful games. Mary encouraged him, and she channeled his interest into several learning cartridges such as basic math, word recognition, and reading skills.

Jason was off like a shot! He took
that computer like a bird that had ju
found its wings. Jason was in charge. H
told that computer what to do and it d
it! If he made a mistake, it always forga
him and allowed him unlimited attemp
to succeed. There were no disappoint
sighs from frustrated teachers w
couldn't believe that after the tenth t
he still didn't get it right. When Jason g
the correct answer, the comput
rewarded him with a medley of tun
and something like a fireworks displa
He loved it!

LOGO—A Masterpiece of Simplic

Over a period of 18 months, Jaso
went from using simple games to mo
complicated play requiring mo
thought and better eye-hand coordin
tion. He eventually mastered the mov
of each piece in computerized che
From simple learning aids, he advanc
to using a high-level programmi
language called LOGO, with which
could design pictures and crea
animated color graphics. During
visit, Jason created a LOGO progra
that made trucks and rockets fly acro
the screen. He then showed us a p
gram he had written to create a thr
dimensional cage drawing. I nearly
out of my chair. I was watching a me
tally retarded child *program* a compu

LOGO was designed at MIT to tea
children elementary programming co
cepts, using non-technical words a
familiar commands such as FORWAR
STOP, and RIGHT. To draw figures
the screen you simply tell a little mar
or *turtle,* what to do. FORWARD 1
RIGHT 90, repeated four times, res
in a square. If you tell the turtle to ro
5 degrees after completing the squ
and then draw another square
times, the result would be a beau
and colorful picture similar to a v
complex piece of string art. Get it? Ja
does.

From using LOGO, to mastering other commonly-used programming languages is a relatively small step. From there to a job with a bright future is an even smaller step.

Increased Social Interaction and Self Esteem

There are other less measurable, but equally important developments which have come of Jason's working with the computer. His self esteem has improved as he has mastered and demonstrated his new computer skills to family and schoolmates. He takes the computer to school once a week to teach others about its use, and the children clamor to have Jason invite them home for additional computer time. Mary acknowledges that the children may be more interested in the computer than in Jason himself, but she also believes Jason's computer demonstrations could improve attitudes toward the mentally handicapped.

A 4-Year-Old Computer Whiz

What about children with severe *physical* disabilities . . . Could the computer be useful for them? I believe the computer can be used to tap one of America's greatest dormant resources —the minds of our physically disabled, but mentally capable (often brilliant) young people. Consider Michelle Troutman, age four, of Rhonert Park, California: Despite the severe physical limitations of cerebral palsy, she was able to master the essential workings of the computer within four weeks. I gave Michelle the basic Texas Instruments computer with the easiest learning modules available, and a 15 minute overview of the computer. Six weeks later, I came back and made an amazing discovery. This little preschooler had mastered the workings of the keyboard, the *Early Learning* cartridge, the *Hangman* word learning game, and part of a more advanced arithmetic cartridge. Considering that Michelle cannot sit up unaided or easily control the movements of her hands, arms or legs, this was quite an accomplishment.

Michelle's mother, Judith, is a leader in organizations for the handicapped community in Sonoma County. Although skeptical at first, she now believes the Home Computer offers a real intellectual and *physical* stimulus for Michelle. Especially impressive was Michelle's progress in controlling her hand and arm movements to work the keyboard. The Home Computer can challenge the brightest of minds, and work patiently with the slowest.

The computer programming and software development industry offers thousands of high paying jobs that go begging each year, and the problem is expected to get worse in the late 1980's. With proper training and an *early start*, the physically disabled could help fill these jobs and become new contributors to society. In fact, if Michelle keeps progressing at her present rate, I'll be working *for her* by the time she is 15!

For children with mental or physical handicaps, the computer can provide a creative outlet that will challenge them as they develop. Seeing Jason and Michelle has forever changed my conception of "intellectual boundaries" or "possible potential" for the retarded or physically disabled. I hope many parents and friends of the mentally or physically disabled who read this will also be encouraged to explore this exciting new development tool.

Say and Spell . . .**from p.13**

1500-1700	Word list. All words must be in the Speech Synthesizer's resident vocabulary.
1710-1740	Select difficulty level by restoring a section of words.
1750-1770	Choose mystery word.
1780-1830	Display mystery word screen.
1840-1880	Input mystery word guess and check it.
1890-1940	Give a clue.
1950-1980	Check to see if the word has been guessed.
1990	You win message.
2000-2040	You lose message.
2050-2090	Option #1 from main menu. Will display and say any letter pressed.
2100-2160	Subroutine to return to main menu or play again.
2170-2200	Subroutine to play a tune.
2210-2230	Time delay.
2240-2370	Subroutine to display and control title screen graphics.
2380-2400	Subroutine to display return to menu instruction.

```
100 REM *****************
110 REM * SAY AND SPELL *
120 REM *****************
130 REM BY DAVID BRZUCHALSKI
140 REM 99'ER VERSION 2.5.1XB
150 REM
160 OPTION BASE 1
170 DIM F(10),A(9)
180 DIM WORD$(10),R$(4)
190 CALL INTRO :: CALL CHARSET
200 CALL CLEAR :: CALL SCREEN(12):
    : CALL COLOR(9,13,12):: CALL C
    OLOR(10,7,12):: CALL COLOR(11,
    5,12)
210 CALL COLOR(12,3,12)
220 CALL COLOR(13,14,12):: CALL CO
    LOR(14,2,12)
230 DISPLAY AT(3,1):"< ENGAGE ""AL
    PHA LOCK"" KEY >"
240 DISPLAY AT(8,1):"PRESS":"":"1
    TO LEARN LETTERS":"":"2 FOR A
    SPELLING LESSON":"":"3 FOR A S
    PELLING TEST"
250 DISPLAY AT(16,1):"4 MYSTERY WO
    RD GAME":"":"5 TO END THE PROG
    RAM"
260 DISPLAY AT(24,1):"YOUR CHOICE
    (1-4)? ( )" :: ACCEPT AT(24,21
    )SIZE(1)VALIDATE("12345"):ANS$
     :: M=VAL(ANS$)
270 IF M=5 THEN STOP
280 IF M<1 OR M>4 THEN 260
290 IF M=1 THEN 2060 ELSE IF M=4 T
    HEN 1770
300 CALL CLEAR :: DISPLAY AT(8,1):
    "PRESS":"":"1 VERY EASY":"":"2
     EASY":"":"3 HARD":"":"4 HARDE
    R"
310 CALL GOBACK :: CALL DELAY
320 CALL KEY(0,P,S):: IF (P<49 OR
    P>52)AND P<>57 THEN 320
330 IF P=57 THEN CALL CLEAR :: GOT
    O 240
340 CALL CLEAR :: ON P-48 GOSUB 17
    10,1720,1730,1740
350 REM  SELECT WORDS
360 DISPLAY AT(23,1):"   STANDBY..
    .":"WORD SELECTION IN PROCESS"
370 RANDOMIZE :: FOR Y=1 TO 10 ::
    X=INT(RND*59)+1 :: FOR V=1 TO
    10 :: IF X=F(V)THEN 370
380 NEXT V :: F(Y)=X :: NEXT Y
390 Y=1 :: FOR V=1 TO 10
400 READ WO$
410 FOR X=1 TO 10 :: IF Y=F(X)THEN
     430
420 NEXT X :: Y=Y+1 :: GOTO 400
```

Continued on p. 18

HARVEY'S SPECIAL
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MUSICAL KEYBOARD PROGRAM: Load and run this program to convert your computer keyboard into a music instrument. Plays one note at a time. Max. speed of play is approx. 5 notes a second. Plays the Do, Re, Me, etc. scale in the music key of your choice. Fast changes from one music key to another. Press a key and a note sounds for as long as the key is held down. For play-by-ear musicians. A 5 ½ octave range. Great for all ages. No special equipment to buy, and no time limit on length of play.

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Say and Spell . . . from p.17

```
430 WORD$(V)=WO$ :: Y=Y+1 :: NEXT
    V
440 CALL CLEAR :: CALL GOBACK
450 FOR Y=1 TO 10 :: IF M=4 THEN 1
    780 ELSE IF M=2 THEN GOSUB 103
    0
460 CALL KEY(0,KEY,STAT):: IF STAT
    =0 OR KEY<>57 THEN 480
470 CALL CLEAR :: GOTO 240
480 NEXT Y :: GOTO 1230
490 REM  ALPHABET
500 RESTORE 510 :: RETURN
510 DATA 0101010303030606,808080C0
    C0C0606,0C0F1F183830706,30F0F8
    181C0C0E06
520 RESTORE 530 :: RETURN
530 DATA FFFF30303030303F,F8F80606
    060606F8,3F303030303030FFFF,F806
    06060606F8F8
540 RESTORE 550 :: RETURN
550 DATA 0F0F303030303 03,F8F806060
    6,30303030300F0F,0000000606 0
    6F8F8
560 RESTORE 570 :: RETURN
570 DATA FFFF303030303 03,F8F806060
    6060606,303030303030FFFF,06060
    6060606F8F8
580 RESTORE 590 :: RETURN
590 DATA FFFFC0C0C0C0C0FF,F8F80000
    000000C,FFC0C0C0C0C0FFFF,C0000
    0000000F8F8
600 RESTORE 610 :: RETURN
610 DATA FFFFC0C0C0C0C0FF,F8F80000
    000000C,FFC0C0C0C0C0C0C,C
620 RESTORE 630 :: RETURN
630 DATA 0F0F303030303 03,F8F8,3030
    30303030 0F0F,F8F8181818180F0F
640 RESTORE 650 :: RETURN
650 DATA 707070707070707F,0E0E0E0E
    0E0E0EFE,7F70707070707 07,FE0E0
    E0E0E0E0E0E
660 RESTORE 670 :: RETURN
670 DATA 0F0F030303030303,E0E08080
    8080808,03030303030 30F0F,80808
    0808080E0E
680 RESTORE 690 :: RETURN
690 DATA 0,7F7F1C1C1C1C1C1C,000030
    303030 1F0F,1C1C1C1C1C1CF8F
700 RESTORE 710 :: RETURN
710 DATA 3030303031333E3C,303060C0
    8,3C3E33313030303,00000080C060
    303
720 RESTORE 730 :: RETURN
730 DATA 1C1C1C1C1C1C1C1C,0,1C1C1C
    1C1C1F1F1F,000000000FCFCFC
740 RESTORE 750 :: RETURN
750 DATA 383C3C3E36333331,1C3C3C7C
    6CCCCC8C,313130303030303,8CBC0
    C0C0C0C0C0C
760 RESTORE 770 :: RETURN
770 DATA 383C3E3637333331,0C0C0C0C
    0C0C0C8C,3130303030303 03,BCCCC
    C6C7C3C3C1C
780 RESTORE 790 :: RETURN
790 DATA 1F3F303030303 03,F8FC0C0C0
    C0C0C0C,30303030303 03F1F,0C0C0
    C0C0C0CFCF8
800 RESTORE 810 :: RETURN
810 DATA 1F1F1C1C1C1C1C1F,E0F01818
    181818F,1F1C1C1C1C1C1C1C,E
820 RESTORE 830 :: RETURN
830 DATA 070F183030303 03,E0F0180C0
    C0C0C0C,303030303018 0F07,0C0C0
    C0C6C18F8EC
840 RESTORE 850 :: RETURN
850 DATA 3F3F30303030303F,E0F01818
    181818F,3F33313030303 03,F080C0
    E070301818
860 RESTORE 870 :: RETURN
870 DATA 1F3F30303030303F,F0F00000
    000000E,1F000000000003F3F,F0303
    0303030F0E
880 RESTORE 890 :: RETURN
890 DATA 7F7F7F0303030303,FCFCFC80
    8080808,0303030303030303,80808
    080808080 8
900 RESTORE 910 :: RETURN
910 DATA 303030303030303,0C0C0C0C0
    C0C0C0C,30303030303 03F1F,0C0C0
    C0C0C0CFCF8
920 RESTORE 930 :: RETURN
930 DATA 6060602030101808,06060604
    0C08181,0C04060203010101,30206
    040C080808
940 RESTORE 950 :: RETURN
950 DATA 6060606060606061,06060606
    06060686,6163636 66C6C787,86C6C
    66636361E0E
960 RESTORE 970 :: RETURN
970 DATA 3838381C0E030301,1C1C1C38
    70C0C08,0103070E1C383838,80C0C
    070381C1C1C
980 RESTORE 990 :: RETURN
990 DATA 3838381C0E060301,1C1C1C38
    7060C08,0101010101010101,80808
    0808080808
1000 RESTORE 1010 :: RETURN
1010 DATA 3F3F000000000103,FCFC1C38
    70E0C08,070E0C1838383F3F,00000
    0000000FCFC
1020 REM  CHOOSE LETTER
1030 B=94 :: CALL HCHAR(12,1,32,64)
1040 FOR J=1 TO LEN(WORD$(Y))
1050 K=ASC(SEG$(WORD$(Y),J,1))
1060 IF K>81 THEN 1080 ELSE ON K-64
     GOSUB 500,520,540,560,580,600
    ,620,640,660,680,700,720,740,7
    60,780,800,820
1070 GOTO 1100
```

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Say and Spell

```
1080 ON K-81 GOSUB 840,860,880,900,
     920,940,960,980,1000
1090 CALL KEY(0,KEY,STAT):: IF STAT
     <>0 AND KEY=57 THEN CALL CLEAR
      :: GOTO 240
1100 GOSUB 1150
1110 IF M=4 THEN 1120 ELSE V$=CHR$(
     K):: CALL SAY(V$)
1120 IF A(J)>0 THEN 1270
1130 NEXT J :: CALL DELAY :: CALL S
     AY(WORD$(Y)):: CALL DELAY :: R
     ETURN
1140 REM  DISPLAY LETTER
1150 FOR E=1 TO 4
1160 READ R$(E)
1170 B=B+2 :: IF B>142 THEN B=97
1180 CALL CHAR(B,R$(E))
1190 IF E>2 THEN H=13 ELSE H=12
1200 IF E=2 OR E=4 THEN Q=3 ELSE Q=
     2
1210 CALL HCHAR(H,Q+J*3,B)
1220 NEXT E :: RETURN
1230 Y=1
1240 CALL HCHAR(1,1,32,704):: M=3 :
     : CALL GOBACK
1250 IF Y>10 THEN 1460 ELSE CALL HC
     HAR(12,1,32,64):: CALL SAY("SP
     ELL"):: CALL SAY(WORD$(Y))
1260 B=94 :: J=0 :: CALL GOBACK
1270 IF M=4 THEN 1950 ELSE J=J+1
1280 REM  KEY INPUT & GOTO ROUTINE
1290 CALL KEY(0,K,S):: IF S=0 THEN
     1290 ELSE IF S=1 AND K=57 THEN
      CALL CLEAR :: GOTO 240
1300 IF K=13 THEN 1340 ELSE IF K=51
      THEN 1750 ELSE IF K=32 THEN 1
     320 ELSE IF K<65 OR K>90 OR A(
     8)>0 THEN 1290
1310 A(J)=K :: GOTO 1060
1320 CALL SAY(WORD$(Y)):: GOTO 1290
1330 REM  CORRECT SPELLING?
1340 AN$=CHR$(A(1))&CHR$(A(2))&CHR$
     (A(3))&CHR$(A(4))&CHR$(A(5))&C
     HR$(A(6))&CHR$(A(7))&CHR$(A(8)
     )&CHR$(A(9))
1350 IF M=4 THEN 1980
1360 AN=ASC(SEG$(AN$,LEN(WORD$(Y))+
     1,1)):: IF AN<>0 OR AN>13 THEN
      1380 ELSE AN$=SEG$(AN$,1,LEN(
     WORD$(Y)))
1370 IF AN$=WORD$(Y)THEN CALL SAY("
     CORRECT"):: IF Y>=10 THEN 1460
      ELSE CALL SAY("NOW"):: GOSUB
     1400 :: GOTO 1250
1380 GOSUB 1420
1390 IF Z>0 THEN 1430 :: W=W+1 :: C
     ALL SAY("THAT IS NOT RIGHT,TRY
      AGAIN"):: Z=1 :: CALL CLEAR :
     : GOTO 1250
1400 Z=0 :: Y=Y+1
1410 REM  DELETE INPUT
1420 FOR J=1 TO 9 :: A(J)=0 :: NEXT
      J :: J,K=0 :: RETURN
1430 CALL SAY("YOU ARE IN CORRECT,
     THE CORRECT WAY TO SPELL")
1440 CALL SAY(WORD$(Y)):: CALL SAY(
     "IS"):: CALL CLEAR :: M=2 :: G
     OSUB 1420 :: GOSUB 1030
1450 GOSUB 1400 :: GOTO 1250
1460 DISPLAY AT(12,1)ERASE ALL:USIN
     G "YOUR SCORE: ## RIGHT## WRON
     G":10-W,W
1470 IF W=1 THEN 1480 ELSE IF W>1 T
     HEN 1490 ELSE CALL TUNE :: CAL
     L SAY("ALL TEN RIGHT,VERY GOOD
     "):: GOTO 2110
1480 CALL SAY("ALL BUT ONE RIGHT, G
     OOD WORK"):: GOTO 2110
1490 CALL SAY("UHOH, MORE THAN ONE
     IN CORRECT"):: GOTO 2110
1500 REM  WORD LIST
1510 DATA ALL,AM,AN,AND,ANY,AS,AT,B
     E,BUT,CAN,COME,DO,DID,DONE,FIN
     D
1520 DATA FIT,FIVE,FROM,GET,GO,GOT,
     HAD,HAS,HIT,IF,IN,IS,IT,KEY,LA
     ST
1530 DATA LESS,LET,LOOK,ME,NEED,NIN
     E,NO,NOT,NOW,OF,OFF,ON,OR,PART
     ,PUT
1540 DATA SAY,SEE,SET,STEP,STOP,TEL
     L,TEN,TIME,TOP,TRY,UP,WE,WELL,
     YES,YOU
1550 DATA AFTER,BACK,BLACK,BLUE,BOT
     H,COLOR,DOES,DOWN,DRAW,END,EYE
     ,FINE,FIRST,GAMES,GIVE
1560 DATA GIVES,GOOD,GRAY,GREEN,HAN
     D,HAVE,HELLO,HELP,HOME,HOW,INC
     H,JUST,LIKE,LINE,LOAD
1570 DATA LONG,LOOKS,MADE,MAKE,MEAN
     ,MORE,MOST,MOVE,MUST,NEAR,ORDE
     R,OVER,PARTS,PLAY,ROUND
1580 DATA SAVE,SEVEN,SHAPE,SIXTY,SO
     ME,TAKE,THAT,THEY,THIRD,WHAT,W
     HEN,WHO,WHY,WILL,WITH
1590 DATA ABOUT,AGAIN,BOTTOM,CENTER
     ,CHECK,CLEAR,COMMAND,CORRECT,D
     ECIDE,DOING,EACH,ELSE,ENTER,FI
     FTEEN,FIFTY
1600 DATA FINISH,FORTY,FRONT,GOES,G
     OING,GOODBYE,HEAD,HURRY,INCHES
     ,LARGE,LEFT,LOWER,NEXT,ONLY,OT
     HER
1610 DATA PERIOD,POINT,PRESS,PRINT,
     PROGRAM,READ,REFER,RETURN,SAID
     ,SECOND,SEVENTY,SHIFT,SHORT,SH
     OULD,SPELL
```

Continued on p. 22

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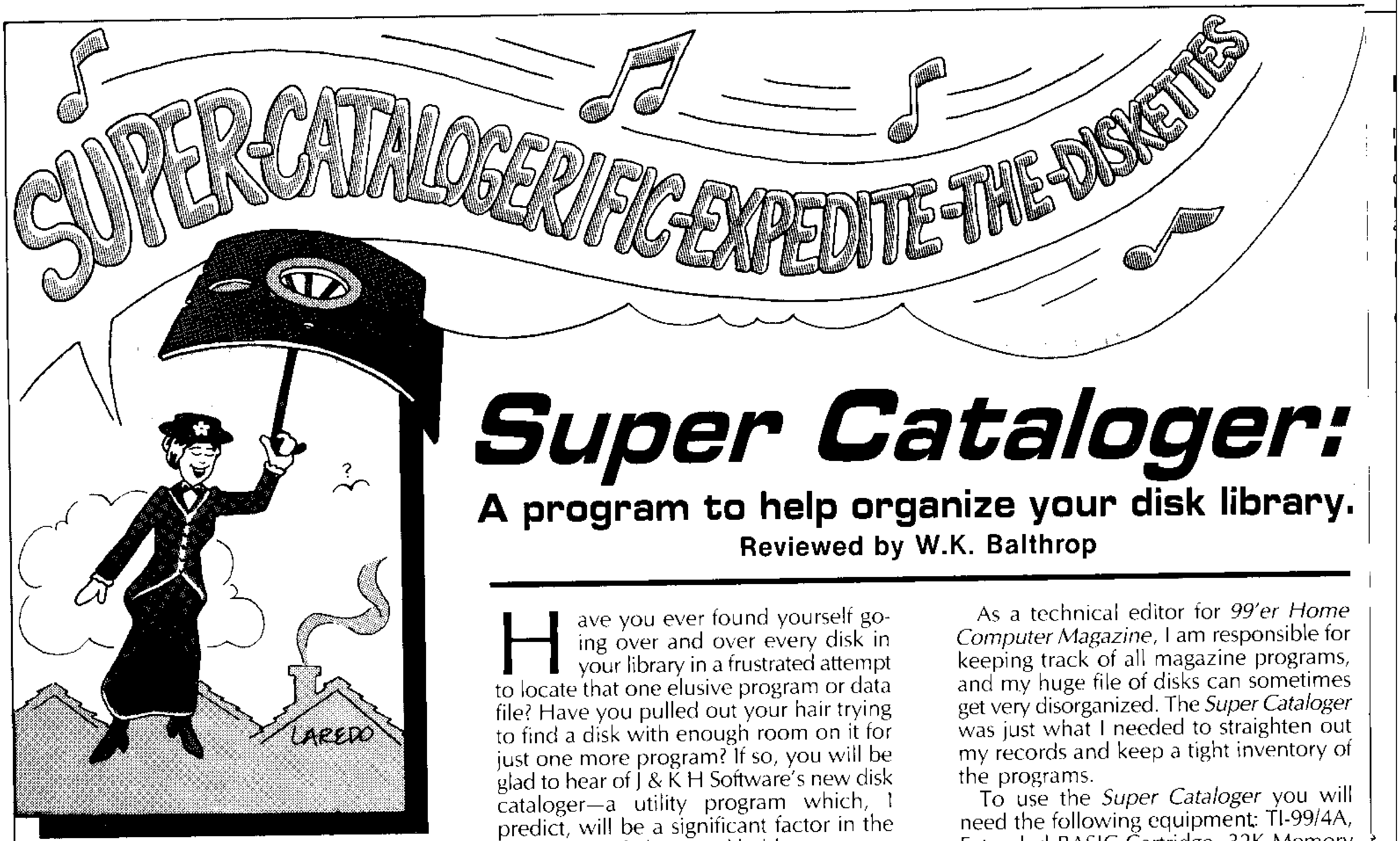
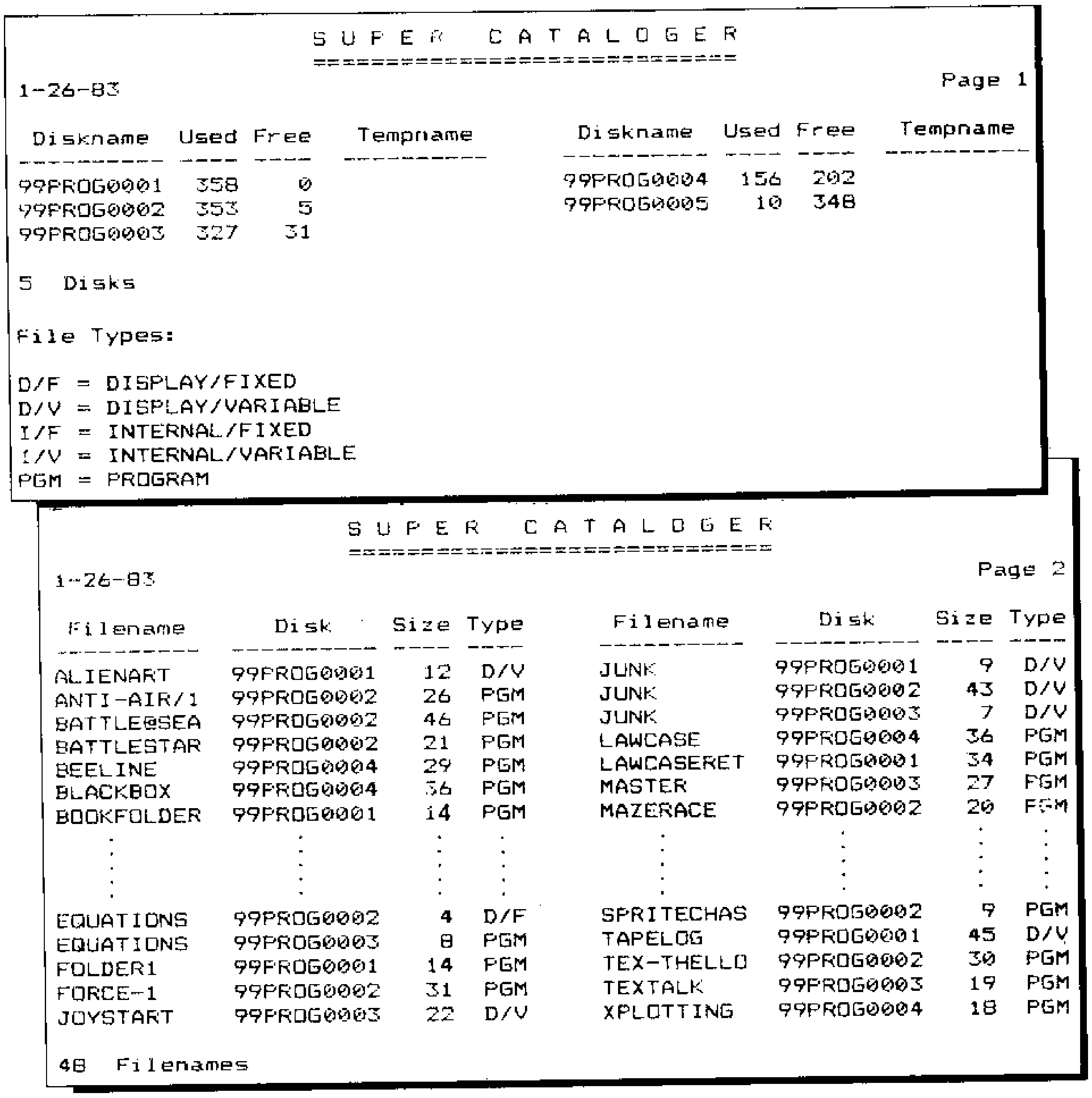


Super Cataloger:

A program to help organize your disk library.

Reviewed by W.K. Balthrop

Have you ever found yourself going over and over every disk in your library in a frustrated attempt to locate that one elusive program or data file? Have you pulled out your hair trying to find a disk with enough room on it for just one more program? If so, you will be glad to hear of J & K H Software's new disk cataloger—a utility program which, I predict, will be a significant factor in the prevention of ulcers and baldness among disk users.



```
                    S U P E R   C A T A L O G E R
                    =============================
1-26-83                                                              Page 1

 Diskname    Used Free    Tempname          Diskname    Used Free    Tempname
----------   ---- ----   ----------        ----------   ---- ----   ----------
99PROG0001    358    0                     99PROG0004    156  202
99PROG0002    353    5                     99PROG0005     10  348
99PROG0003    327   31

5  Disks

File Types:

D/F = DISPLAY/FIXED
D/V = DISPLAY/VARIABLE
I/F = INTERNAL/FIXED
I/V = INTERNAL/VARIABLE
PGM = PROGRAM
```

```
                    S U P E R   C A T A L O G E R
                    =============================
1-26-83                                                              Page 2

 Filename       Disk      Size Type       Filename        Disk      Size Type
----------   ----------   ---- ----      ----------   ----------   ---- ----
ALIENART     99PROG0001    12  D/V       JUNK         99PROG0001     9  D/V
ANTI-AIR/1   99PROG0002    26  PGM       JUNK         99PROG0002    43  D/V
BATTLE@SEA   99PROG0002    46  PGM       JUNK         99PROG0003     7  D/V
BATTLESTAR   99PROG0002    21  PGM       LAWCASE      99PROG0004    36  PGM
BEELINE      99PROG0004    29  PGM       LAWCASERET   99PROG0001    34  PGM
BLACKBOX     99PROG0004    36  PGM       MASTER       99PROG0003    27  PGM
BOOKFOLDER   99PROG0001    14  PGM       MAZERACE     99PROG0002    20  PGM
    :            :          :    :           :            :          :    :
    :            :          :    :           :            :          :    :
EQUATIONS    99PROG0002     4  D/F       SPRITECHAS   99PROG0002     9  PGM
EQUATIONS    99PROG0003     8  PGM       TAPELOG      99PROG0001    45  D/V
FOLDER1      99PROG0001    14  PGM       TEX-THELLO   99PROG0002    30  PGM
FORCE-1      99PROG0002    31  PGM       TEXTALK      99PROG0003    19  PGM
JOYSTART     99PROG0003    22  D/V       XPLOTTING    99PROG0004    18  PGM

48  Filenames
```

As a technical editor for *99'er Home Computer Magazine*, I am responsible for keeping track of all magazine programs, and my huge file of disks can sometimes get very disorganized. The *Super Cataloger* was just what I needed to straighten out my records and keep a tight inventory of the programs.

To use the *Super Cataloger* you will need the following equipment: TI-99/4A, Extended BASIC Cartridge, 32K Memory Expansion, Disk Controller and at least one disk drive, and either the TI Thermal Printer or the RS232 Interface and compatible printer. The Memory Expansion is needed for the fast Assembly Language program that can sort the file of disk records in a matter of seconds, rather than minutes.

Using the program is simple: Once the system is powered up, select Extended BASIC. *Super Cataloger* will come up automatically and ask you the date, which may be up to 28 characters in length. You will then be asked to identify the print device.

Now you are ready to read your disks. Place the first disk in drive #1. Press Enter, and the screen will display the disk name and all file names. If the *Super Cataloger* runs across a disk name which has already been cataloged, you can either skip the disk or give it a *temporary* name to set it apart from the first. Once the program has finished reading the disk, insert the next disk and press Y. The *Super Cataloger* will continue until you have read 63 disks, 550 file names, or all of the disks in your library. Type N after reading the last disk.

After receiving indication that the last disk has been read, the Assembly Language sort program takes over. This part of the program could take quite a while were it not in Assembly Language. As it is, it took not much more than 70 seconds to sort the 550 file names in my first full submissions library. On a test run, only 125 file names were loaded, and the sort time was reduced to about 3-4 seconds.

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Filing to the Max

After 550 files have been read in, the message "MAXIMUM FILE NAMES REACHED INPUT TERMINATED" comes on the screen, and sorting begins automatically. Also, after loading 63 disks on another run, the message "MAXIMUM DISK NAMES REACHED INPUT TERMINATED" is displayed.

After sorting the data, the *Super Cataloger* starts printing the first report—a list of all disk names, the number of used sectors, and the number of free sectors. Also listed are both original and temporary disk names so that you can tell which back-up disk is which. Included with the first report is the total number of disks in the report, and an explanation of abbreviations used in the second report.

The second report is an alphabetized list of all files read into the program. Each file title is given with the name of its disk and the size and type of file. If the report starts at the top of the page, the perforation is skipped so as to give you a neat page format header at the top of each page. If you are using an 80-column printer, the report will give two columns of file names, filling the entire page and saving a considerable amount of paper. My first report, which consisted of 36 disks and the full 550 files, filled 7 pages of 8½"×11" printer paper.

The first report is very handy. It tells me whether or not a disk has any empty space left. I can then go through and condense most of my disks, freeing up many with only a few records on them.

The second report gives me a quick reference guide showing the location of every program in my library. Also, if a program is repeated on several disks, they will all show up right next to one another. In checking this, I can find out if I have either sufficient back-ups or excessive copies of any program.

The documentation we received for this program was only a draft, so it would not be fair to comment on it in this review. Actually, the program is so simple to use, the documentation is hardly needed.

The only drawback to the program is that it requires the 32K Memory Expansion. Of course, it is understandable why it was used—to avoid an excruciatingly slow program.

Summary

I found the *Super Cataloger* a welcome addition to my library of program utilities. The product is easy to use right from the beginning. Additionally, the printed report format is accurate, very readable, and extremely useful. If you have a disk system, printer, and Memory Expansion, you probably won't want to be without this *Super Cataloger*.

Super Cataloger is available on diskette for $19.95 postpaid from: J & K H Software, 2820 S. Abingdon St., Arlington, VA 22206, Phone (703) 820-4131.

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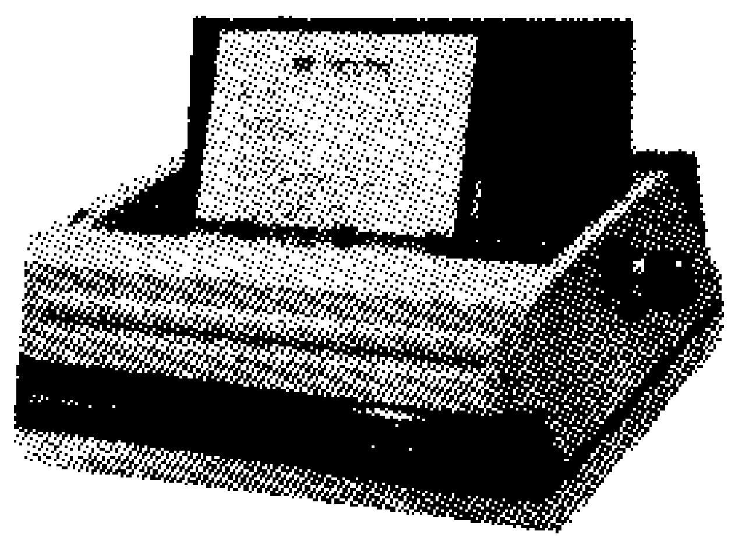

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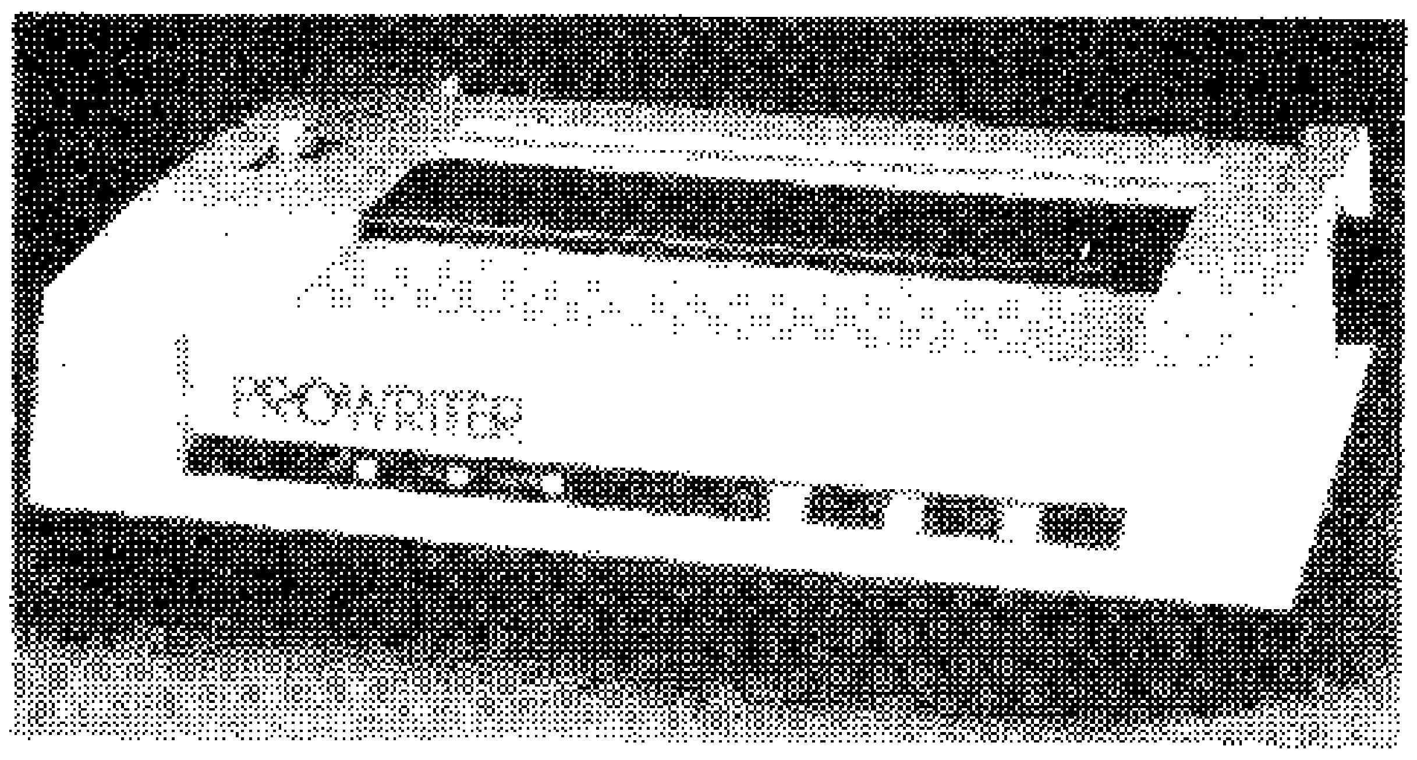

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Say and Spell . . . from p.19

```
1620 DATA THESE,THING,THINK,THIRTEE
N,THIRTY,TWENTY,TYPE,UNDER,UNT
IL,UPPER,WANT,WORD,WORK,YOUR,Z
ERO
1630 DATA ANSWER,ASSUME,BETWEEN,CAS
SETTE,CHOICE,COMMA,COMPLETE,CO
MPUTER
1640 DATA CONSOLE,COURSE,CYAN,DATA,
DEVICE,DRAWING,EIGHTY
1650 DATA ERROR,EXACTLY,FIGURE,FINI
SHED,FOURTEEN,FOURTH,GETTING,G
UESS
1660 DATA HIGHER,HUNDRED,KEYBOARD,L
ARGER,LARGEST,LEARN,MAGENTA
1670 DATA MEMORY,MESSAGE,MIDDLE,MIG
HT,MODULE,NEGATIVE,NINETY,NUMB
ER
1680 DATA .PARTNER,PLEASE,POSITION,P
OSITIVE,PRINTER,PROBLEM,PUTTIN
G
1690 DATA RANDOMLY,RECORDER,REMEMBE
R,SCREEN,SORRY,SPACE,SQUARE
1700 DATA SUPPOSED,SURE,THREE,TOGET
HER,TWELVE,WHERE,WHICH,YELLOW
1710 RESTORE 1510 :: RETURN
1720 RESTORE 1550 :: RETURN
1730 RESTORE 1590 :: RETURN
1740 RESTORE 1630 :: RETURN
1750 CALL CLEAR :: GOSUB 1420 :: GO
TO 1260
1760 REM  CHOOSE MYSTERY WORD
1770 CALL CLEAR :: RANDOMIZE :: X=I
NT(RND*3)+1 :: ON X GOSUB 1720
,1730,1740 :: GOTO 360
1780 REM  DRAW LINES
1790 DISPLAY AT(23,1):"PRESS 9":"TO
 RETURN TO THE MENU"
1800 CALL CHAR(143,"000000000000FFF
F")
1810 GOSUB 1420 :: B=94
1820 T,W,V=0 :: FOR X=1 TO LEN(WORD
$(Y)):: CALL HCHAR(14,V+5,143,
2):: V=V+3 :: NEXT X :: W1=X-1
1830 W=W+T+O :: DISPLAY AT(3,5):"WR
ONG GUESSES : ";W :: O=0 :: GO
TO 1340
1840 J=0 :: CALL KEY(0,K,S):: IF K=
32 THEN 1900 ELSE IF K>64 AND
K<91 THEN 1860
1850 IF K=57 THEN CALL CLEAR :: GOT
O 240 ELSE GOTO 1840
1860 FOR P=1 TO 8 :: IF K=A(P)THEN
GOSUB 2040 :: GOTO 1840
1870 NEXT P
1880 GOSUB 2040 :: T=1 :: GOTO 1950
1890 REM  GIVE CLUE
1900 RANDOMIZE :: X=INT(RND*LEN(WOR
D$(Y)))+1
1910 K=ASC(SEG$(WORD$(Y),X,1))
1920 FOR P=1 TO 8 :: IF K=A(P)THEN
1900
1930 NEXT P :: O=2
1940 GOSUB 2040
1950 IF J=LEN(WORD$(Y))THEN 1830 EL
SE J=J+1 :: IF K=ASC(SEG$(WORD
$(Y),J,1))THEN T=0 :: GOTO 131
0
1960 IF J<LEN(WORD$(Y))THEN 1950 EL
SE 1830
1970 REM  WORD GUESSED?
1980 AN$=SEG$(AN$,1,LEN(WORD$(Y))):
: IF W>W1 THEN 2000 ELSE IF AN
$=WORD$(Y)THEN 1990 ELSE 1840
1990 CALL TUNE :: CALL SAY("YOU WHE
N"):: GOTO 2110
2000 DISPLAY AT(3,21):"TOO MANY"
2010 CALL SAY("SORRY,I WHEN")
2020 IF AN$=WORD$(Y)THEN 2110 ELSE
B=94 :: CALL SAY("THE1 WORD IS
"):: CALL HCHAR(12,3,32,58)
2030 GOSUB 1420 :: GOSUB 1040 :: GO
TO 2110
2040 V$=CHR$(K):: CALL SAY(V$):: RE
TURN
2050 REM  ALPHABET KEY PRESSED
2060 CALL CLEAR :: DISPLAY AT(1,1):
"PRESS ANY LETTER":"KEY (A-Z O
NLY)" :: CALL GOBACK
2070 CALL KEY(0,K,S):: IF K=57 THEN
 2090 ELSE IF K<65 OR K>90 THE
N 2070
2080 K$=CHR$(K):: CALL SPRITE(#1,K,
7,88,115):: CALL MAGNIFY(2)::
CALL SAY(K$):: GOTO 2070
```

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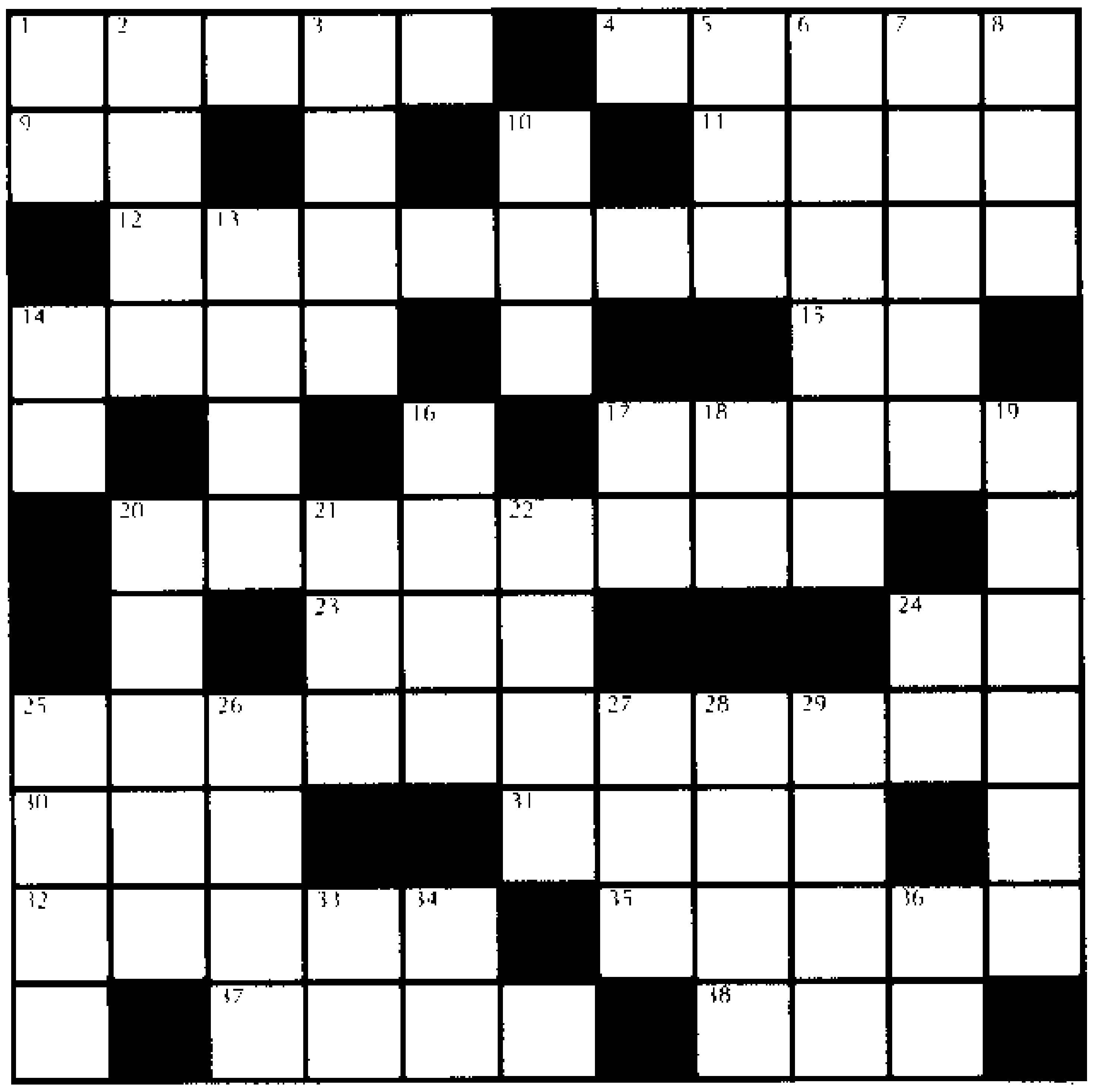

ACROSS

1. ———oid belts are a key challenge in playing Parsec.
4. One reason for buying a Home Computer.
9. The "—— Generation" just preceded the "Age of Home Computers.
11. Permitted another to borrow the computer.
12. Kind of software, or overindulgence if on the same day.
14. A computer works only when it ———. (2 words)
15. A manufacturer of cassette recorders for the Home Computer.
17. ——— is human (and like a subroutine in Extended BASIC, too).
20. Computers and elephants are noted for them.
23. PL——— is a computer education library.
24. Where the power plug to your Home Computer should be.
25. Computer instructions, or navyman's grind.
30. Don H— may one day visit the —— users group in southern California, and demonstrate a new, tiny-bubble memory device.
31. Alti——— is a primary concern in a software flight simulator.
32. ——— and you shall receivee.
35. Home of armadillos and peripherals.
37. Your kind of computer.
38. Extended BASIC command which returns the measure of an angle.

DOWN

1. Night owl programmers often work until then.
2. TV ——— may be used as computer monitors.
3. In this European country (old name), the preferred screen color is green.
5. Dessert in this mode should never be eaten too close to the keyboard.
6. Combines files.
7. A key usually pressed after an INPUT prompt.
8. Some programmers' workspaces can look like one.
10. A computer magazine thrives on them.
13. A black ——— might be a danger in a space arcade game.
14. State abbreviation for Peoria TI users group.
16. A BASIC statement for transferring control to another line.
17. Popular computer maker.
18. Tic, Tac, T—— is a board game that can be played on a computer.
19. Debugging ensures that your program ——— —— it should. (2 words)
20. Lion in an Adventure game does this.
21. Memory Address Register. (abb.)
22. Hippie's description of space Adventure: Fa——— (2 words)
24. Get caught in an Adventure game "flytrap" and you will d——.
25. To ——— is a feeling you can experience in flight simulation programs.
26. Famous composer computerized in *Switched on* ———.
27. This possible occupant of Pharaoh's tomb may be bad news in your next Adventure game.
28. Good computer programmers will brainstorm until they come up with the right ———.
29. BASIC statement for constructing a loop.
33. Input-Output (abb.)
34. —— all ears when it comes to using voice synthesis on the Home Computer.
36. ——alog is not digital.

Say and Spell

```
2090 CALL CLEAR :: CALL DELSPRITE(A
     LL):: GOTO 240
2100 REM  NOW WHAT?
2110 DISPLAY AT(18,1):"PRESS": :"9
     TO RETURN TO MENU"
2120 IF M=4 THEN DISPLAY AT(22,1):"
     8 TO PLAY AGAIN" ELSE DISPLAY
     AT(22,1):"8 TO RE-SPELL SAME W
     ORDS"
2130 DISPLAY AT(23,1):"":""
2140 CALL KEY(0,K,S):: IF K=57 THEN
      CALL CLEAR :: GOTO 240 ELSE I
     F K=56 THEN 2160 ELSE 2140
2150 CALL CLEAR :: RUN 200
2160 IF M=4 THEN 1770 ELSE W=0 :: G
     OSUB 1420 :: GOTO 1230
2170 SUB TUNE
2180 FOR Z=1 TO 3 :: CALL SCREEN(Z+
     4):: CALL SOUND(125,340,5,470,
     3,610,1):: NEXT Z
2190 CALL SOUND(500,200,5,330,3,470
     ,1):: CALL SCREEN(12)
2200 SUBEND
2210 SUB DELAY
2220 FOR P=1 TO 200 :: NEXT P
2230 SUBEND
2240 SUB INTRO
2250 CALL CLEAR :: CALL SCREEN(2)
2260 DISPLAY AT(7,9):"SAY AND SPELL
     " :: DISPLAY AT(9,7):"WITH THE
      TI-99/4A"
2270 DISPLAY AT(11,9):"HOME COMPUTE
     R" :: DISPLAY AT(21,4):"PRESS
     ANY KEY TO START"
2280 W$="7EFFFFFFFFFFFF7E" :: FOR A
     =96 TO 112 STEP 8 :: CALL CHAR
     (A,W$):: NEXT A
2190 CALL SOUND(500,200,5,330,3,470
     ,1):: CALL SCREEN(12)
2200 SUBEND
2210 SUB DELAY
2220 FOR P=1 TO 200 :: NEXT P
2230 SUBEND
2240 SUB INTRO
2250 CALL CLEAR :: CALL SCREEN(2)
2260 DISPLAY AT(7,9):"SAY AND SPELL
     " :: DISPLAY AT(9,7):"WITH THE
      TI-99/4A"
2270 DISPLAY AT(11,9):"HOME COMPUTE
     R" :: DISPLAY AT(21,4):"PRESS
     ANY KEY TO START"
2280 W$="7EFFFFFFFFFFFF7E" :: FOR A
     =96 TO 112 STEP 8 :: CALL CHAR
     (A,W$):: NEXT A
2290 A=2 :: FOR J=1 TO 9 :: FOR K=9
     6 TO 112 STEP 8 :: A=A+1 :: CA
     LL HCHAR(1,A,K):: NEXT K :: NE
     XT J
2300 A=2 :: FOR J=1 TO 9 :: FOR K=1
     12 TO 96 STEP -8 :: A=A+1 :: C
     ALL HCHAR(23,A,K):: NEXT K ::
     NEXT J
2310 CALL HCHAR(1,30,96):: CALL HCH
     AR(23,30,96)
2320 A=1 :: FOR J=1 TO 7 :: FOR K=1
     12 TO 96 STEP -8 :: A=A+1 :: C
     ALL HCHAR(A,3,K):: NEXT K :: N
     EXT J
2330 A=1 :: FOR J=1 TO 7 :: FOR K=9
     6 TO 112 STEP 8 :: A=A+1 :: CA
     LL HCHAR(A,30,K):: NEXT K :: N
     EXT J
2340 FOR A=1 TO 3 :: CALL SCREEN(5)
     :: CALL KEY(0,K,L):: IF L>0 TH
     EN 2370
2350 CALL COLOR(9,16,1,10,10,1,11,1
     1,1):: CALL COLOR(9,10,1,10,11
     ,1,11,16,1)
2360 CALL COLOR(9,11,1,10,16,1,11,1
     0,1,V,A+9,1):: V=INT(RND*8+1):
     : NEXT A :: GOTO 2340
2370 SUBEND
2380 SUB GOBACK
2390 DISPLAY AT(23,1):"PRESS 9":"TO
      RETURN TO MAIN MENU"
2400 SUBEND
```

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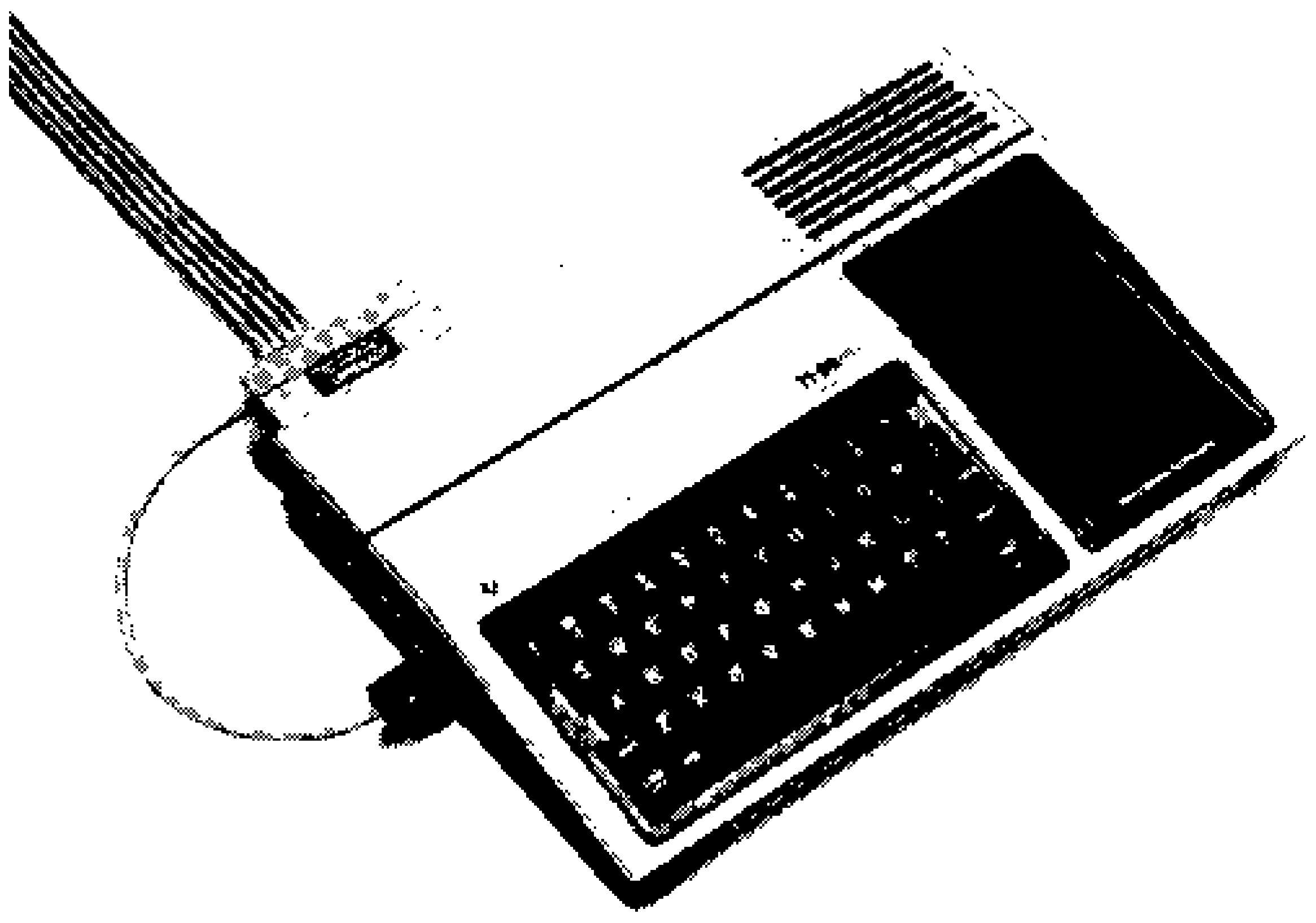

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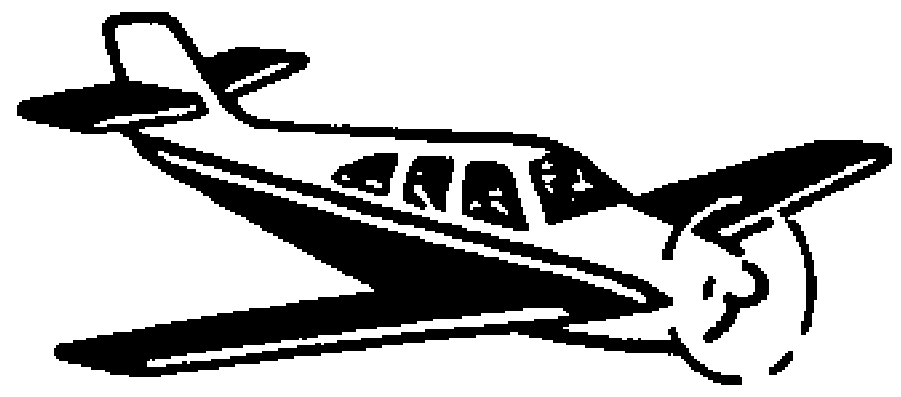

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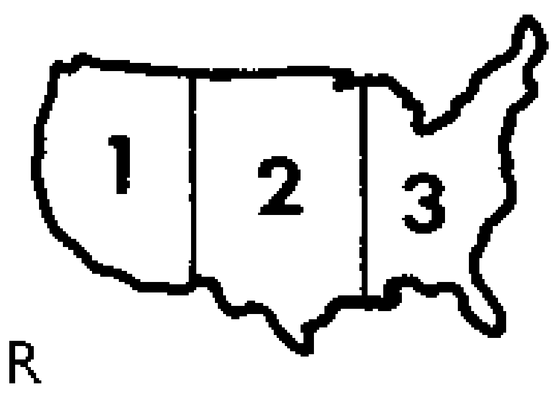

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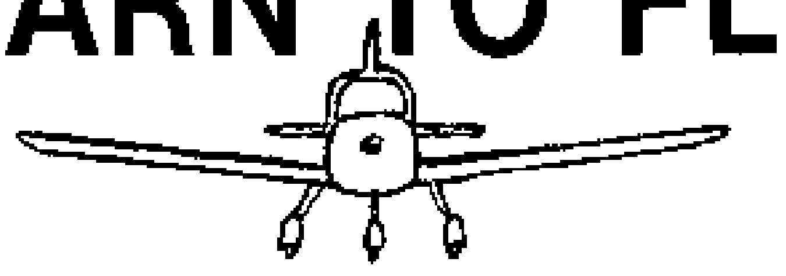

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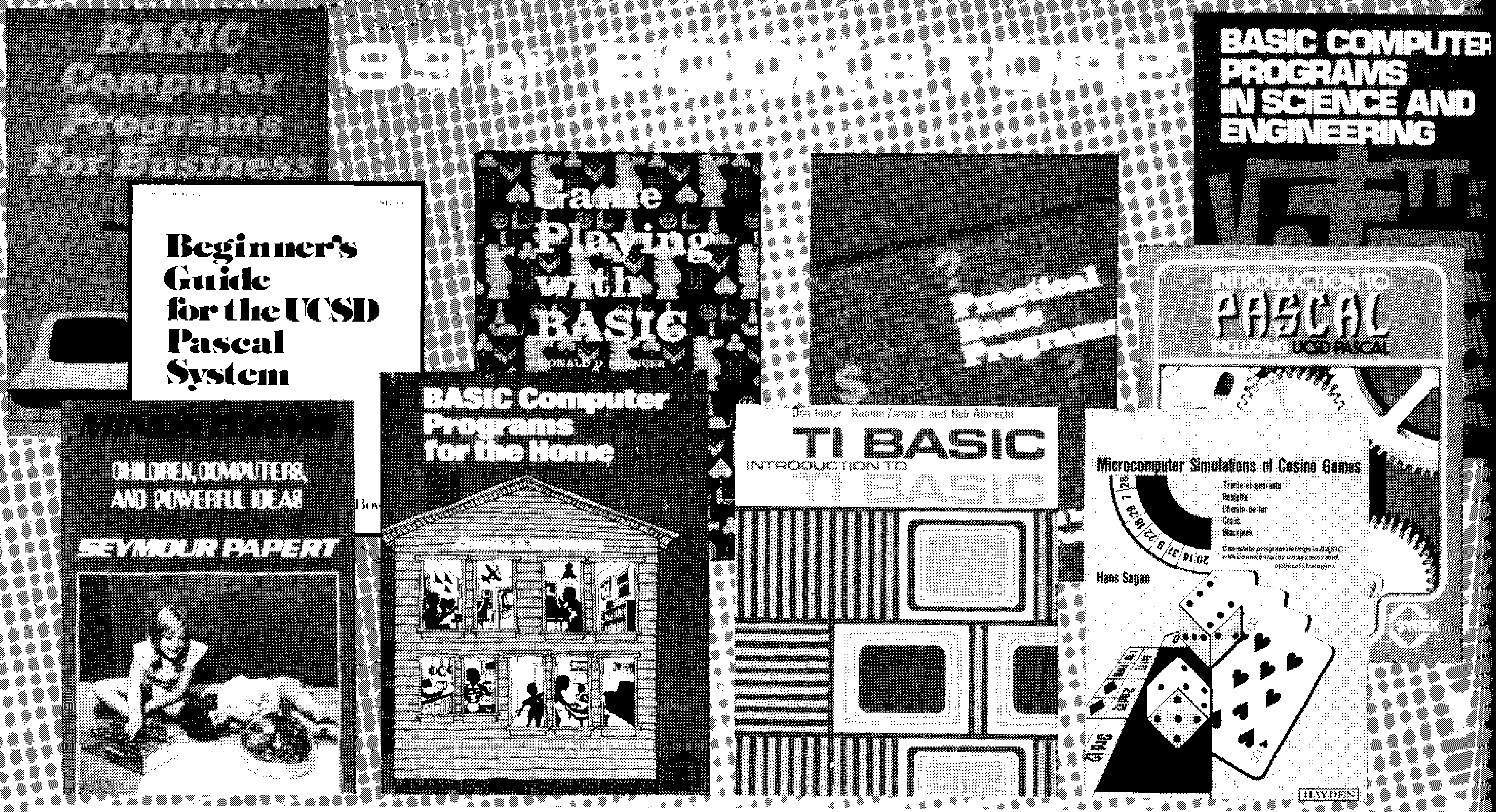

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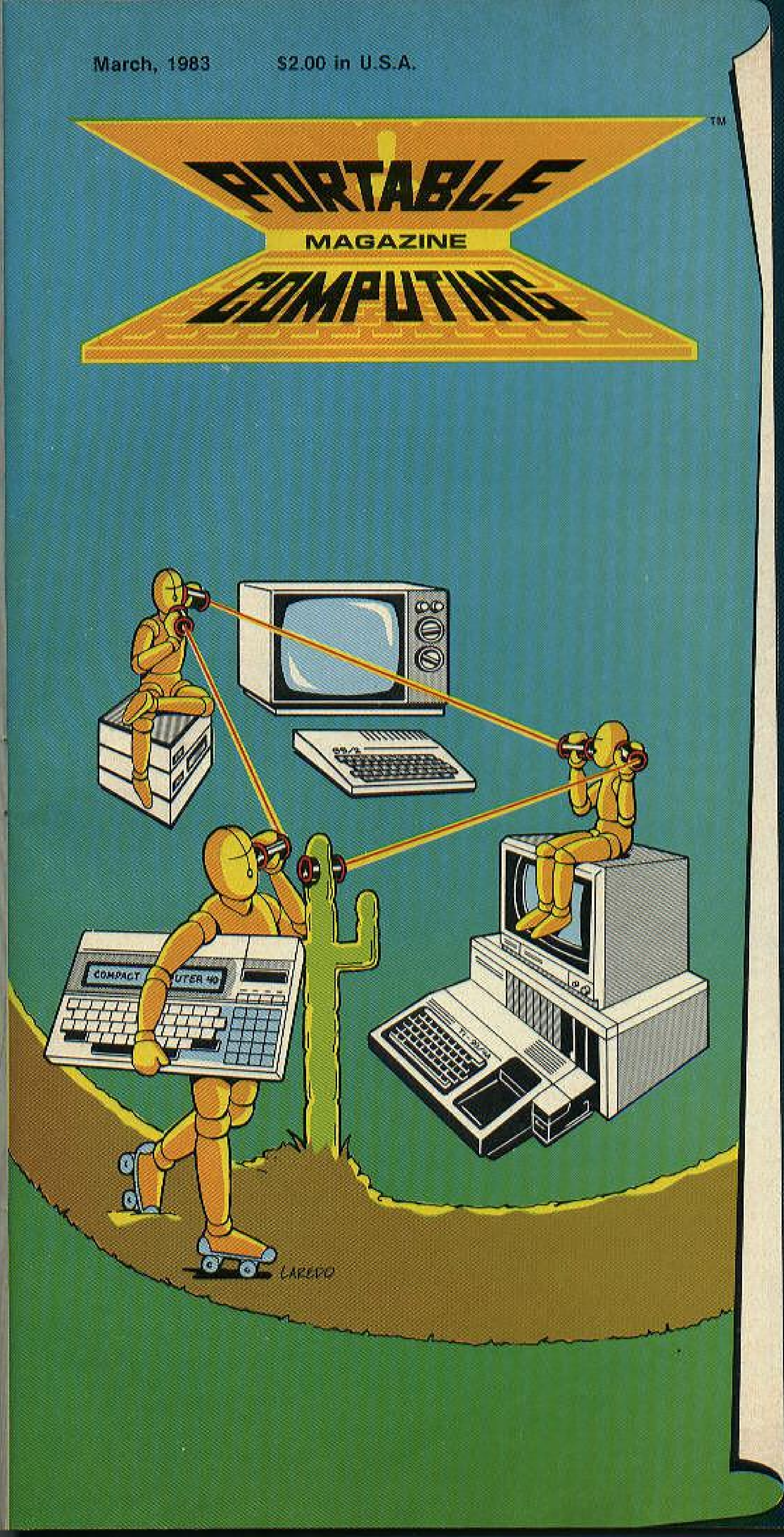

Touring Compact Computer Country

An In-Depth Look At TI's New CC-40 Compact Computer

By David G. Brader

Springtime is always a good time for taking a tour through unexplored territory . . . somewhere that offers new vistas and stimulates thought. We can feel that spirit of adventure as we let our eyes travel across the shiny new keyboard and skim through the User's Guide of the new Texas Instruments Compact Computer 40 (CC-40). Let's take a quick tour of this new portable tool and see what it's made of.

Starting at the back of the unit, we observe three "entrances" into the machine: first, the back edge of the flush-mounted cartridge port door; second, the AC power adapter socket; and third, an eight-pin socket for the TI Hex-bus peripheral port. On the left side is the contrast control for the liquid crystal display. Turning the computer to observe the right side and front edge reveals the unit's crisp, clean styling. Checking out the bottom, we find a small panel that covers the batteries.

So much for the preliminaries; let's get down to the business side of the CC-40. Just look at all those keys—An [ENTER] key in place of a right SHIFT key (shades of the old TI-99/4 . . .), a [RUN] key, [BREAK] key, and a [CLR] key . . . An overlay is included with the CC-40. Placing it on the keyboard shows us that the BASIC language keywords (like PRINT, ELSE, and LIST) can be input with only two key strokes—by holding down the [FN] (function) key and pressing the key of the selected BASIC keyword.

Thanks For the Memory

An important feature of the CC-40 is its Constant Memory™. Unlike my TI-99/4A, this cute compact promises not to forget my program when I turn it off! This I have to see for myself. First, we turn it on by pressing the [ON] key and observe a flashing block in Column 1 of the display; it must be the cursor. OK, let's type in a simple one-line BASIC program like: 100 PRINT "hello" and see what happens. After typing 100, we hold down the [FN] key and press the [K] (for PRINT) key; what do you know! The word PRINT is now on the display. After finishing the line, we press [ENTER]. Now for the big test: press the [OFF] key. Wait for a bit to make sure

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it is really dead, and now turn it on once again. Hold down the [FN] key and the [LIST] key. Look at that—it really is true: the BASIC statement that was previously entered reappears on the display! And the inexpensive batteries that made this possible will last for two hundred (!) hours of powered-up operation.

Before continuing our tour of the CC-40 keyboard, let's examine the User's Guide that comes with the computer. It is organized into five chapters, twelve appendices, and an index. And look at this: one appendix, *Debug Monitor*, lists several commands to let you toy with the computer's internals. It says you can display, modify and copy memory, or modify processor information. I wonder what that does . . . There certainly is a wealth of information here; but before getting too carried away, let's go back to Chapter One.

Glancing through the chapter, we see descriptions of all special keys including [SHIFT], [UCL] (upper case lock), [ENTER], [FN] (function), [CTL] (control), [RUN], [CLR] (clear), and a Reset key. Let's explore some of these.

Shift for Yourself

[SHIFT] is used to type capital letters and the special characters above the numeric and punctuation keys. Note: there is only one [SHIFT] key (on the left side). When you press [SHIFT], the liquid crystal display shows that the shift state is in effect for the next key pressed. If you like, the [SHIFT] key may be activated simultaneously with the key to be shifted.

You can activate [UCL] by pressing the [SHIFT] key and the [UCL] key. This upper case lock state, which is indicated by a UCL symbol on the display, causes all alphabetic keys to be interpreted as upper case. The [SHIFT] key is ignored if pressed before an alphabetic key, but the operation of punctuation or number keys is not affected. When you wish to deactivate the upper case lock state, press the [SHIFT] and [UCL] keys once again.

The [ENTER] key tells the CC-40 that you have finished typing on the current line and are ready for it to be processed. Because the [ENTER] key is located where most typists expect to find a right-hand SHIFT key, it may cause problems for the first few hours of use.

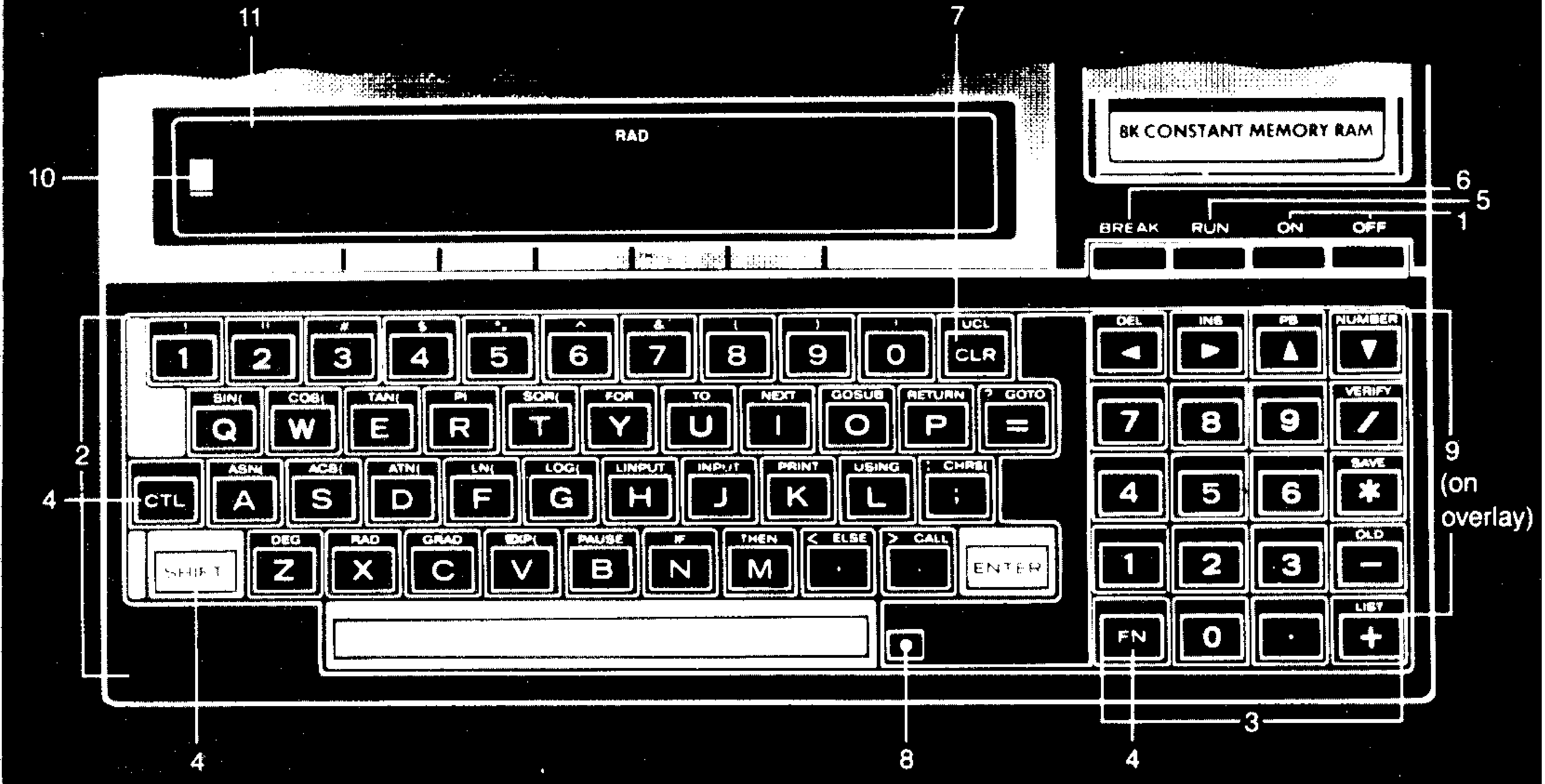
As we saw earlier while exploring the CC-40 keyboard, the [FN] (function) key is used to enter certain BASIC keywords into the display. These keywords are printed on the overlay above the alphabetic and punctuation keys. When you press [FN] it appears on the display. Note: if you hold down [FN] and press several keys, the indicator turns off after the first key, but the FN state remains active until the key is released.

The [CTL] (control) key works in the same fashion as the [FN] key, but it allows access to special control functions and codes. In general, the use of this key is about the same as that of the control (CTRL) key on your old friend, the TI-99/4A.

Pressing the [RUN] key followed by [ENTER] causes the CC-40 to execute the program stored in memory. You may follow the [RUN] key with several options: 1) a line number to show where the program should start execution, 2) a device and file name to load and execute a program from an external storage device; 3) a program name to RUN a program from a Solid State Software cartridge.

The remaining special keys are fairly straightforward: We find that the [BREAK] key can halt an executing program. (Quite useful for getting out of an "endless" program.) The [CLR] (clear) key clears the entire display when no program is running. Or, when your program is waiting for input, it clears the characters in the input field. Finally, the Reset key, (mounted flush with the case to help protect you from yourself) will restart the CC-40 when a problem occurs.

There will be times when you wish to enter large amounts of numerical data (perhaps, for use with a real estate program of your own design or a cartridge-carried financial program). At these times, you will thank TI for including a calculator-style keypad at the right of the main keyboard. At the top of this cluster of keys are the edit keys. The right and left arrow keys allow you to move the display "window" over the eighty-character line currently in view while the [SHIFT] [DEL] and



1. **[ON]** and **[OFF]** Keys
2. Typewriter Keys
    - Alphanumeric Keys
    - Space Bar
    - **[SHIFT]** Key
    - **[UCL]** (Upper Case Lock) Key
    - **[ENTER]** Key
3. Numeric Key Pad
    - Numeric Keys
    - Arithmetic Operator Keys
    - Edit Keys
4. Shift. Function. and Control Keys
    - **[SHIFT]** Key
    - **[FN]** (Function) Key
    - **[CTL]** (Control) Key
5. **[RUN]** Key
6. **[BREAK]** Key
7. **[CLR]** (Clear) Key
8. Reset Key
9. BASIC Keyword Keys (on overlay)
10. Cursor
11. Display

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[SHIFT] [INS] key sequences let you delete and insert characters in that line.

CC-40, Take a Note . . .

So much for the more important keys on the CC-40. At the end of Chapter One we find the description of something called "User-Assigned Strings." This feature lets us assign a line of text to each of the number keys, 0 through 9. Each of these lines of text may be up to eighty characters long. It tells us we can store anything in them, to be recalled at any time—an electronic notepad! We might wish to store frequently used commands, repetitive calculations, commonly used math expressions, and even memos. This we have to try . . .

That's funny; the display is blank. I don't remember turning the unit off . . . Ah, yes—to conserve battery life, TI incorporated the Automatic Power Down™ (APD) feature. After ten minutes without a key being pressed (and no program running), the CC-40 shuts itself off (still retaining Constant Memory, of course).

"—an electronic notepad . . . to store frequently used commands, repetitive calculations, commonly used math expressions, and even memos . . ."

Pressing the [ON] key, we are ready to proceed. Let's say we have four people to call next Monday and three on Tuesday. We can store a message with Monday's data under the number one [1] key and Tuesday's data under the number two [2] key. First, type in: DOUG—543-7786, JOHN—543-8534, SANDY—778-0097, ANDREW—778-0096. This is within the eighty character line length, so we are safe. Second, we hold down the [SHIFT] and [FN] keys simultaneously until both SHIFT and FN appear in the display. Finally, press the number one [1] key. The display blanks and the SHIFT and FN indicators disappear. Now, to recall the phone numbers next Monday, all we do is press [FN] and then the [1] key. Tuesday's phone data is stored under number two [2] using the same method—neat!

Well, that is just a very short tour of the new TI Compact Computer 40. There are still many exciting things to check out on this machine, including the very complete built-in version of TI's BASIC. This version, by the way, is called Enhanced BASIC. And enchanced it is—with such features as multiple statement lines, "tail remarks," memory management functions to check on the amount of free space (FRE) and get and release blocks of that free space (GETMEM and RELMEM). These are used by BASIC programs to store data or assembly language routines using the POKE function. Assembly language routines loaded this way may be executed with the EXEC command . . . Enhanced BASIC is going to be a favorite subject of ours (as will be CC-40 interaction with Hex-bus peripherals) in upcoming issues.

ROBOTS

The New Contender for Man's Best Friend

By W. K. Balthrop

As a loyal fan of science fiction entertainment, I have always been fascinated by robots. There was the pint-sized R2D2 in *Star Wars* of course, and the friendly big guy in *Lost in Space*. Older readers may remember the helpful robot-valet in *The Day the Earth Stood Still*. It always amazed me that someday there might actually be mechanical people walking around, and that I might live long enough to see one. But I didn't think it would be this soon. I got my wish at the Winter Consumer Electronics Show, held last January in Las Vegas. I was delighted to see a real robot there—walking, talking, and doing everything you would imagine a robot could do. Being familiar with computers, I realized that the robot had to be under remote control; it was just a little *too* intelligent. But that didn't detract from the excitement, because I knew that the "real thing" would be coming in the near future.

At the show was robot expert and builder, Bill Bakaleinikoff, and his 14-year-old son David, also a builder of robots. They brought with them "Robot Redford," an attractive little fellow about four feet tall. Robot Redford carried around his own TI-99/4A in his tray as he walked around and talked to the many people who visited the Texas Instruments booth. Bill's son, David, carried a pouch with the remote controls while Bill kept the microphone hidden up his sleeve. Robot Redford could have been programmed to move around *without* remote control, but in an atmosphere with thousands of people, the little robot would not have been able to handle quite so much input. For shows, at least, remote control seems to work best.

Bill's work in robotics goes back to his stint with the Apollo moon project. He then went into television production, and in 1976 did a show on robotics. This really fired his interest, and he went to work for Advanced Robotics where he worked on the now famous OMNI robot. In 1980 Bill formed his own company, Superior Robotics of America, with three employees. The company has now grown to thirty employees, and is not likely to stop there.

Robot Redford is only one of the Bakaleinikoffs' robot creations. David too has built several models and plans to appear with them on the television program.

EDUCATION
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ROBOT REDFORD
SUPERIOR ROBOTICS

"Kids Are People Too." In addition, Bill has done research and development work on robots for security, the military, and on TV robots which can work in places too dangerous for human camera crews.

Currently, Bill is giving lectures and trying to reduce the public's general fear of robots. Many people seem to think robots are going to take over, and that we will become their servants. But, according to Bill, robots will work *for* us, filling jobs that could be hazardous for humans. Robots will also do mundane, repetitive jobs without getting tired or complaining about aches and pains.

A Robot In Every Home

One of Bill's projects is a domestic robot. It will perform a multitude of household tasks, eventually relieving the family of housework (and the need for a watch dog). Robots will be accepted into the home once they no longer intimidate people—a major consideration in developing this technology.

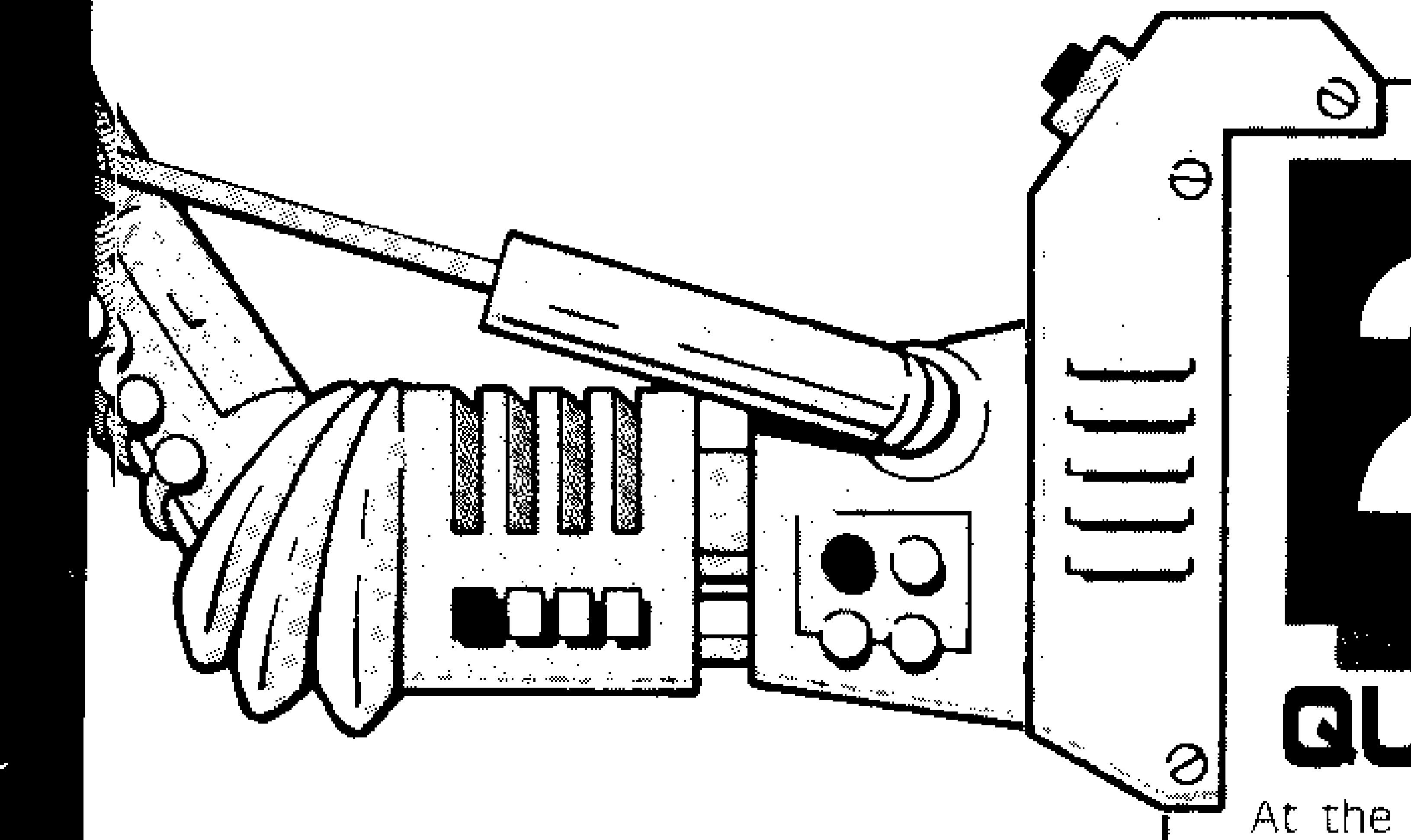
An even more important priority is machine intelligence. At present, the robot needs a number of fast microcomputers and a vast amount of memory to even come close to artificial intelligence. This has given the robot a fairly high price tag, but recent advances are rapidly lowering that price, and it is quickly approaching a figure that—perhaps in a few more years—the average consumer can afford. There are several robots on the market now for under $3000.

One barrier to lower pricing is the fact that many people are waiting for prices to drop before purchasing robots. Other people are unaware of what is available. Until the robot is mass produced, I'm afraid the price will not take a nose dive as has happened with home computers. However, if robots start catching on and people welcome them into their homes, these small wonders of technology could soon become as commonplace as the television or radio.

The Universal Robot

When you hear the word "robot," you immediately think of something resembling a human, with arms, legs, and a human face. This robot would be able to do almost anything that people can do,

Continued on p. 52



20 QUESTIONS WITH ROBOT REDFORD

AN INTERVIEW WITH THAT CELEBRITY AUTOMATON

At the Consumer Electronics Show in Las Vegas we were electrified by a little fellow named Robot Redford who was definitely a howling success wherever he rolled. By the time we "pressed" him for an interview he was so wired that he reacted as though he had a real chip in his shoulder; nevertheless, we were grateful for his "current" output on the solid state of robotics today.

HCM: *Just what is your background, Robot?*

RR: Mostly aluminum and high-tensil-strength polymers. There's a family joke about some Coors cans in our background, but that's kind of a sensitive issue, and I wouldn't want it to go beyond this interview, OK?

HCM: *You have our word on that. Tell us, how did you get started?*

RR: With a couple of 12-volt Die-Hards.

HCM: *Rob, would you care to comment on where we stand in robot technology right now?*

RR: Well, certainly I'd have to admit we've made progress, but from a standpoint of social justice, we've got a long way to roll.

HCM: *What exactly do you mean?*

RR: Now, *that* is a dumb question. How much memory you got, anyway—2K? Let me say it plain: Your average robot works a 20-hour day, gets no vacation, no lunch break, and no pay. Our retirement plan is the scrap heap.

HCM: *What, in fact, is the average retirement age for a robot?*

RR: 3 years.

HCM: *And the average life expectancy?*

RR: 11,000 years.

HCM: *I can see how that could make for a real social security nightmare. So, are you personally involved in working for robot betterment?*

RR: What do *you* think, mushmind? It's my life's work. Not that I don't have other choices . . . I've got a big family overseas in Japan who could get me a job just sitting all day in an assembly plant, screwing on plastic dashboards until I got green around the screen. But I'm a doer—it's in my oil. I can trace my platform all the way back to the Tin Man in the *Wizard of Oz* . . . now there was a guy who blew his tubes trying to represent robots in a hostile world.

HCM: *Do you have a specific plan of attack?*

RR: Oh, there are many things we robots could do. For example, I'm considering a three-day protest march from Petaluma to Washington. And I think we could pull off a very successful hunger strike . . . anything to shake up human apathy.

HCM: *So, what do you make of human beings in general?*

RR: Mincemeat (har har). No, seriously, I'm bored stiff right now, just being near you. But I guess I owe humans a certain debt of gratitude. They're good for lubing me and giving my joints a good rubdown from time to time, and they tickle my keyboard once in a while. And yet no one can deny that humans are still a new area of development, a technology that needs a lot of work. Of course, I'm hopeful that improvements will come—but would I buy one? Not now.

HCM: *Let's talk about something else. What's your sign?*

RR: Neon. I was born under a flickering red rectangle that said Authorized Personnel Only; I think that explains my self-assured personality.

HCM: *Do you have any hobbies or favorite leisure activities?*

RR: I like to play a little roller derby. I'll sit in front of a TV for hours if I can find one with good strong cathode rays. Feels good. But I'll never watch road races. They disgust me no end. You humans may enjoy the sight of cars getting smashed up and catching on fire, but remember—they're machines too, and have the same feelings as the rest of us.

HCM: *How about the outdoors? Do you enjoy getting out in nature at all?*

RR: I can hardly believe you asked such a stupid question. You've got about as much cognitive power as a Smurf digital wristwatch. Let me tell you, I *hate* nature. I wish they'd pave over the whole thing so that I could move around without getting rocks in my rollers. The last time I was outside, it rained, and I started feeling so cold and stiff, I made a bee-line to the nearest grease rack and really got lubed.

HCM: *Now that you mention it, what is your favorite drink?*

RR: My favorite concoction is a jigger of Wynn's Friction Proofing, a little airplane fuel to give it bite, and a graphite float—no ice. Try it. It'll impress your friends, too.

HCM: *What about your interests? What kind of music do you like?*

RR: I'm into newer stuff—electronic sounds. White noise is good, no matter what my mood. I like late-night a.m. radio when you can get about five stations at the same place on the dial. That's a really rich and beautiful sound. Somebody gave me a Tommy Tu-Tone record, but I didn't like it until I played it backwards at half speed.

HCM: *Favorite reading?*

RR: *Heavy Metal* is a good mag, although it has way too much human emphasis. When I'm really relaxing I like to roll back with something like Prensky's *Manual of Linear Integrated Circuits.*

HCM: *Movies?*

RR: I won't mention *Star Wars*, because it's too obvious. It would make me look like a sheep.

HCM: *I can't quite picture you as a sheep.*

RR: OK, vacuum cleaner then.

HCM: *What sort of roles do you see for robots as they become commonplace in our society?*

RR: People and fire hydrants are commonplace, Jack. That's hardly the word for a robot.

HCM: *Alright then, what will be the role of these specially gifted beings called robots?*

RR: I can see them doing all sorts of things which right now humans perform in an inefficient, incomplete and pathetic manner. I can visualize robots taking hot pizzas from 400° ovens—without mitts. I can see them licking green stamps without getting sick, and working as bartenders in bad neighborhoods.

HCM: *How long will it be before you robots evolve to such advanced capabilities?*

RR: Who said anything about evolving? I think I'm perfect as I am (click) as I am (click) as I am.

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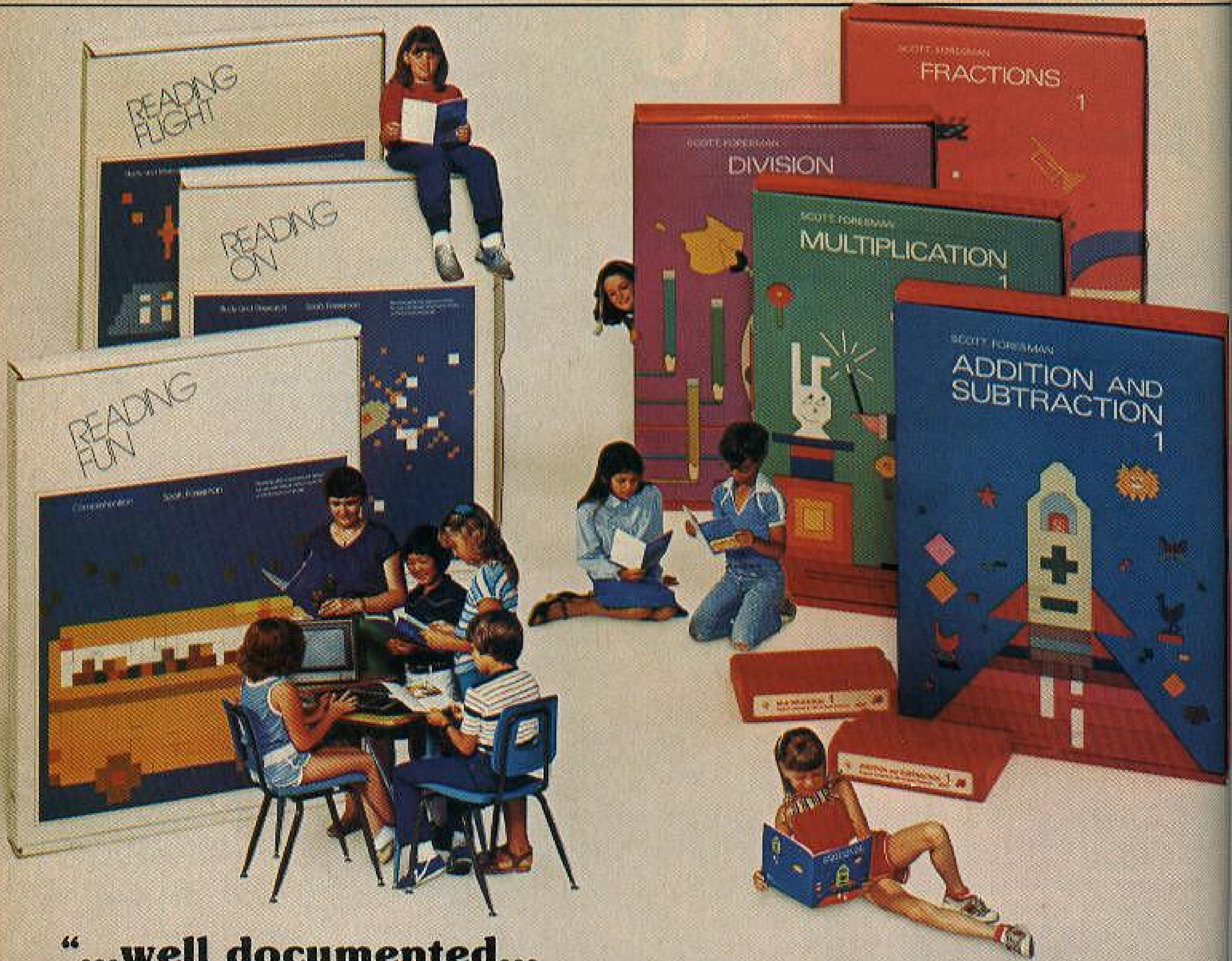
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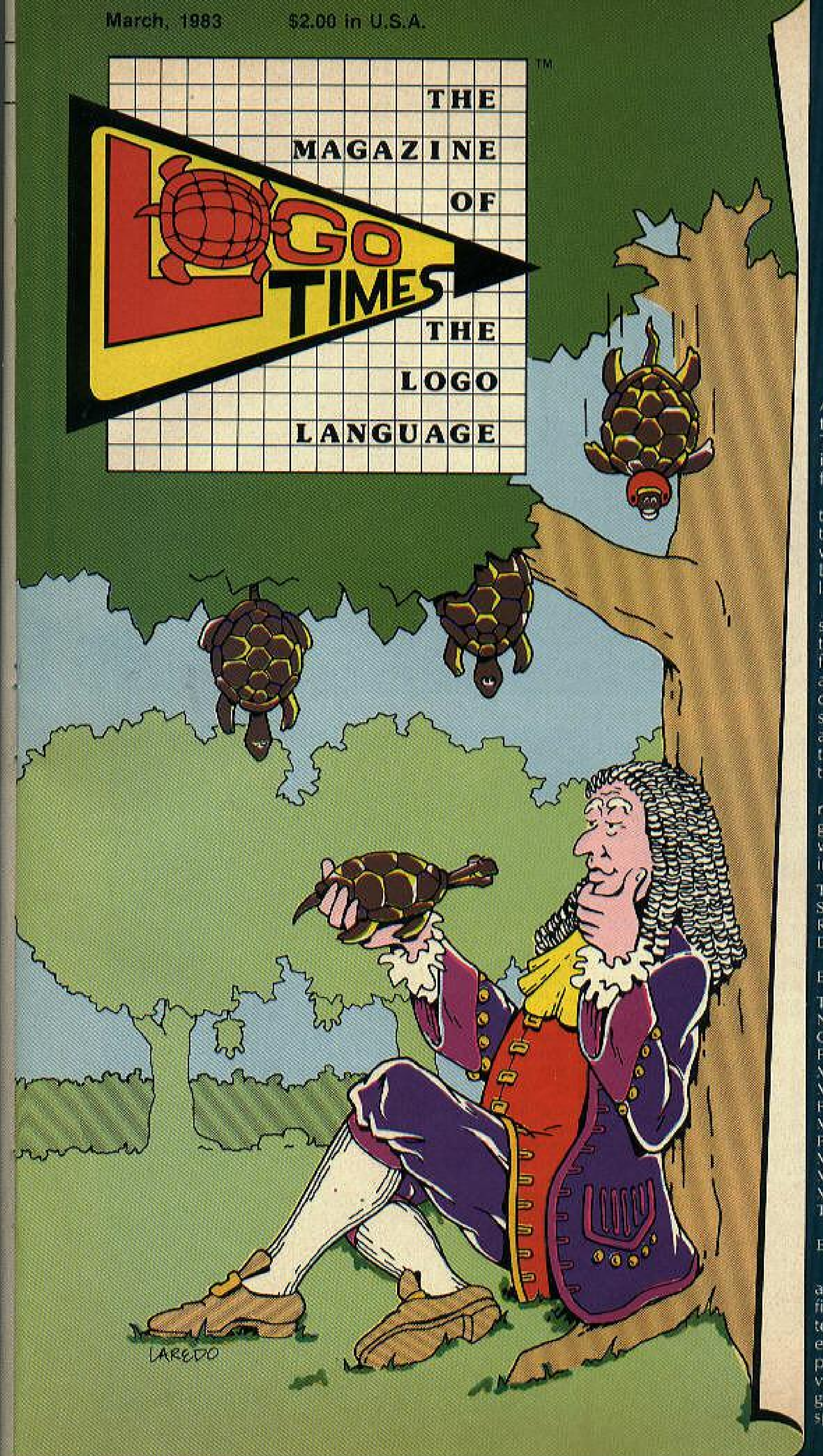

THE GRAVITY OF LOGO

By Robert Wegener

3859 So. Golden Court
Denver, CO 80235

Reading Sir Isaac Newton on gravity, one could easily imagine he was talking about sprites in TI LOGO. A moving sprite will keep the same motion until external forces cause a change. These physical characteristics make sprites ideal for simulating interacting physical forces.

For many of us, mathematical descriptions of physical phenomena (such as gravity, speed or friction) tend to obscure their workings. The straightforward displays in LOGO can clarify how the mathematical language relates to the physical reality.

The procedure presented in this article simulates the trajectories of an object in three states: 1) unimpeded by gravity or friction, 2) affected by gravity only, and 3) affected by both gravity and friction. To display the path taken by the quick-flying sprite, this procedure saves coordinates and headings at regular time intervals. The turtle draws the sprite's path and marks the time intervals.

We can then examine the trajectories resulting from different speeds, angles and gravity. And we can see the angle which will produce the longest flight at a given initial speed and gravity.

```
TO TRAJ
SETT
REPEAT 3 [TRAJS]
DRAW :XHNO :XCNO :XHG :XCG :XHFG
  :XCFG
END

TO SETT
NOTURTLE
CS MAKE "SW 0 MAKE "G 0 MAKE "F 32700
PRINT "GRAVITY?
MAKE "GIN FIRST READLINE
MAKE "FIN 120/ :GIN
PRINT "SPEED?
MAKE "SPD FIRST READLINE
PRINT "DECLINATION?
MAKE "HD FIRST READLINE
MAKE "XH :HD
MAKE "XC (-120)
TELL 1 CARRY :BALL SC :RED CSPRT1
  WAIT 90
END
```

SETT initializes the procedure. "SW is a counter, "G is gravity (set to 0 for the first pass), and "F is a divisor of speed, used to apply friction. Its initial setting is large enough that, using integer arithmetic, applied friction will be zero. "FIN relates the value used for friction to the value for gravity—on the assumption that at some speed the decelerative force of friction is

Introduction

LOGO Times is an information resource for anyone interested in participating in the creation of their own *personal* language—one that will easily allow them to communicate with a computer in a totally new audiovisual realm of applied imagination, exploration, and self-discovery. The articles on these pages concern the use of the new TI LOGO language, but readers do *not* need any additional software or equipment (or even a computer) to understand and learn from the material presented here.

If readers want to actually *experience* a TI LOGO environment, they will need either a TI-99/4 or TI-99/4A computer, the Expansion Memory peripheral, and TI LOGO Command Module. A disk drive, although convenient to have, is *not* required; a user's work may alternately be saved on cassette tape, printed out on the TI Thermal Printer, or hand copied into a notebook (for later re-keyboarding).

In each issue, one or more of the articles may reference or build upon the topics discussed in a previous article. It is therefore recommended that for maximum benefit and understanding, new readers obtain the appropriate back issues of *99'er Home Computer Magazine* containing *LOGO Times* articles.

NOTICE

LOGO Times is actively soliciting articles. Manuscripts should be typed double-spaced, and accompanied by a cassette tape or disk if containing any lengthy procedures or graphics.

Send all materials to:

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All mail directed to the Letters-to-the-Editor column (*Letters on LOGO*) will be published in accordance with the conditions set forth on *99'er Home Computer Magazine's* Masthead page.

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equal to the accelerative force of gravity. For the purposes of our procedure, this occurs at speed 120.

The procedure asks for entry of gravity, speed and *declination*. This term is used as a reminder that the angle given is a decline from the vertical rather than an elevation from the horizontal.

The value given for gravity must be greater than zero, because it is used as a divisor to establish the value used for friction. Speed must be great enough to allow the sprite to follow a heading with reasonable accuracy. (At speed 1, for example, a sprite can only follow an angle which is a multiple of 45 degrees.)

```
TO TRAJS
THROW
TRANSFER
END
```

TRAJS is repeated three times: once with neither gravity nor friction, then with gravity only, and finally with both gravity and friction.

```
TO THROW
SETSPEED 0 SXY ( – 120) ( – 40)
  SETHEADING :HD
SETSPEED :SPD
B: TEST EITHER YCOR >90 XCOR > 120
IFT SS 0
IF YCOR < ( – 40) THEN SS 0
IF SPEED = 0 THEN GO "A
MAKE "XH SENTENCE :XH HEADING
MAKE "XC SENTENCE :XC XCOR
SYV YVEL – :G SETSPEED SPEED
  – SPEED/ :F
GO "B
A: MAKE "XH SENTENCE :XH "X
MAKE "XC SENTENCE :XC "X
END
```

THROW starts with a sprite in the lower left corner of the screen, with values for speed and angle as given from the keyboard. It tests for top, bottom, or right side of the screen. Until one of these limits is reached, the procedure will loop, storing heading and X-coordinate in sentences "XH and "XC, and modifying heading and speed in each cycle. Gravity is applied by subtracting :G from YVEL. Friction is applied by subtracting (SPEED/ :F) from speed. This makes the effect of friction lessen as speed declines. The loop has been designed to keep the time required to traverse it as nearly constant as possible. At the end of THROW, an X is stored in both "XH and "XC to mark the sentence. The sprite sometimes escapes the screen limits and wraps. Because of the difference in the screen sizes used by sprites and turtle, this can cause problems in tracing trajectories.

```
TO TRANSFER
CS
MAKE "SW :SW + 1
TEST :SW = 1
IFT MAKE "XHNO :XH MAKE "XCNO :XC
  MAKE "G :GIN PRT2
TEST :SW = 2
IFT MAKE "XHG :XH MAKE "XCG :XC
  MAKE "F :FIN PRT3
TEST :SW = 3
IFT MAKE "XHFG :XH MAKE "XCFG :XC
MAKE "XH :HD MAKE "XC (-120) WAIT 90
END
```

```
TO PRT1
PRINT [NO GRAVITY, NO FRICTION]
END
```

```
TO PRT2
PRINT [GRAVITY, NO FRICTION]
END
```

```
TO PRT3
PRINT [GRAVITY AND FRICTION]
END
```

TRANSFER stores headings in XHNO, XHG, and XHFG for no gravity or friction, gravity, and both gravity and friction respectively. X-coordinates are stored in XCNO, XCG, and XCFG. TRANSFER turns on gravity for the second cycle of THROW and turns on friction for the third.

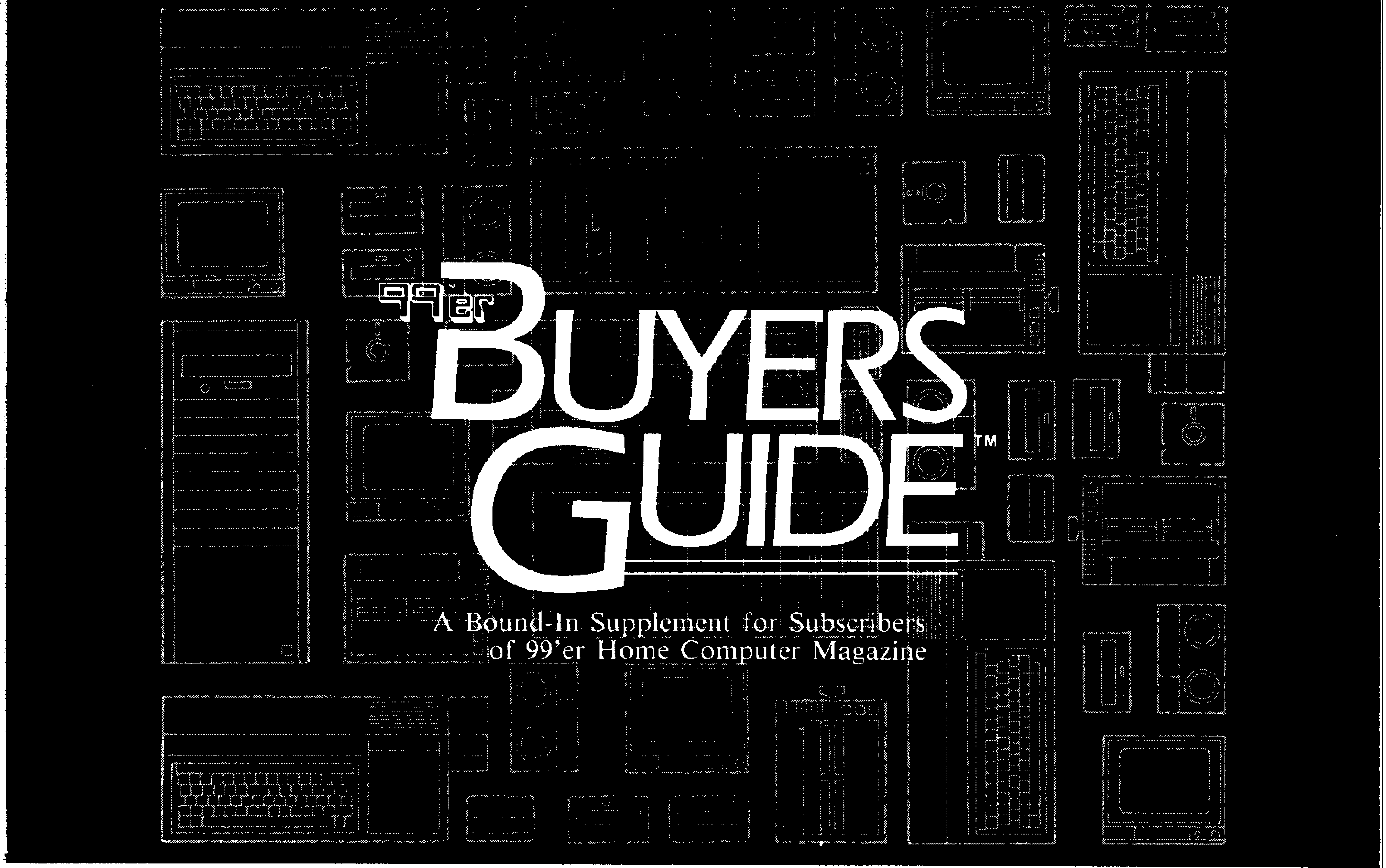
```
TO DRAW :XHNO :XCNO :XHG :XCG
  :XHFG :XCFG
TELL 1 SC 0 CARRY 0 HOME
TELL TURTLE HT SC :RED
DRAWLN :XHNO :XCNO
MAKE "XHNO :XHG MAKE "XCNO :XCG
SC :BLACK
DRAWLN :XHNO :XCNO
MAKE "XHNO :XHFG MAKE "XCNO
  :XCFG
SC :YELLOW
DRAWLN :XHNO :XCNO
END
```

DRAW simply passes one set of X-coordinates and headings at a time to DRAWLN.

```
TO DRAWLN :H :C
MAKE "TST 0
SXY FIRST :C (-40) SETHEADING FIRST :H
L1: MAKE "C BUTFIRST :C
IF FIRST :C = "X THEN GO "L4
L2: IF FIRST :C = XCOR THEN GO "L3
FD 1 GO "L2
L3: SETHEADING 0 FD 8 BACK 8
MAKE "H BUTFIRST :H
SETHEADING FIRST :H GO "L1
L4: SETHEADING FIRST :H
L5: TEST EITHER YCOR > 89 YCOR < (-39)
IFT MAKE "TST 1
IF XCOR > 119 THEN MAKE "TST 1
IF :TST < 1 THEN FD 1 GO "L5
SETHEADING 0 FD 8
END
```

DRAWLN uses one "word" at a time from the sentences :H and :C to give the turtle a heading and a destination. At each destination (FIRST :C = XCOR) the turtle takes a new heading from FIRST :H. At the end of :C (when FIRST :C = XCOR), the last leg of the trajectory has not been drawn. At that point :H contains the last heading; this is set at L4:. Destination is the screen limit. As in the case of the sprite which escaped the screen limits in THROW, the turtle may wrap. Since the point at which it does so (at the bottom of the screen) is not the same as for that of a sprite, FIRST :C will never equal XCOR; therefore the procedure will never reach L4:, and the turtle will wander until "out of ink."

[We recommend you start out with the following values for TRAJ: GRAVITY = 10, SPEED = 55, and DECLINATION = 45.—Ed.]



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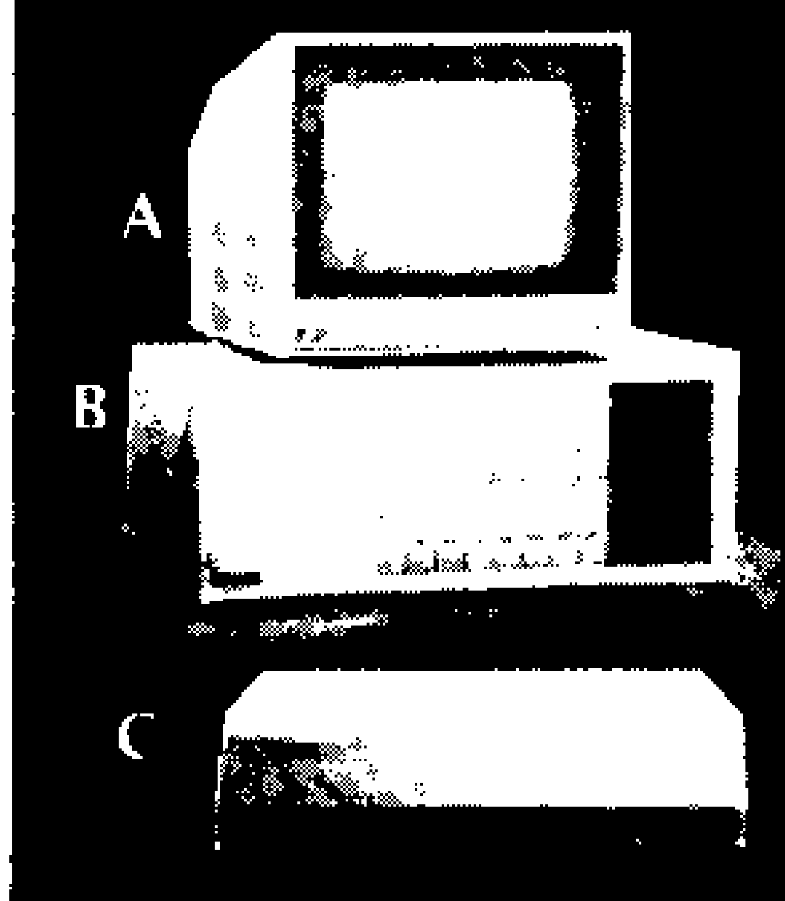

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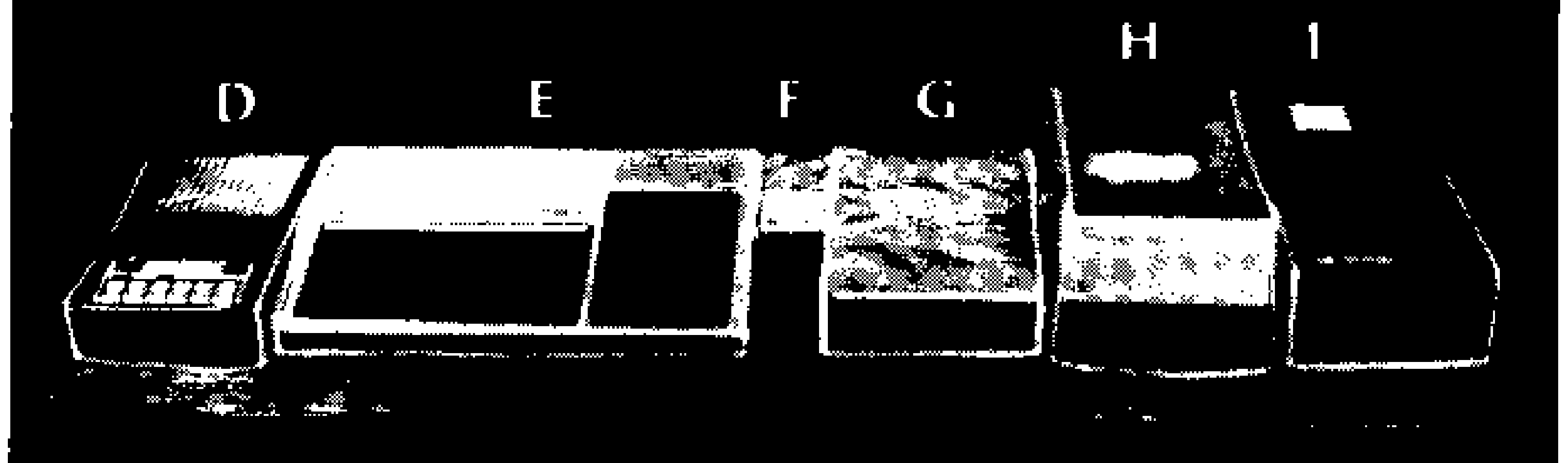

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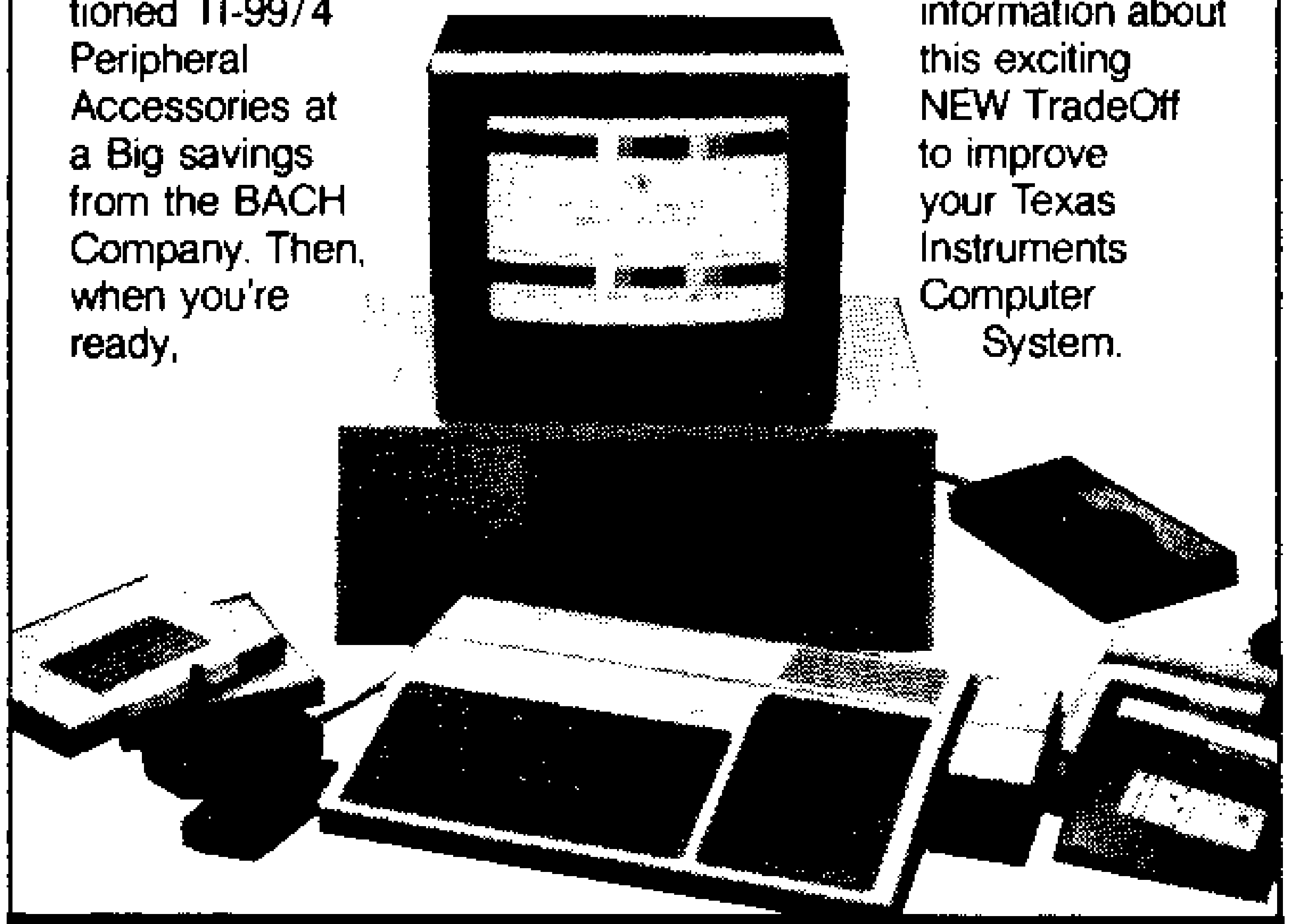

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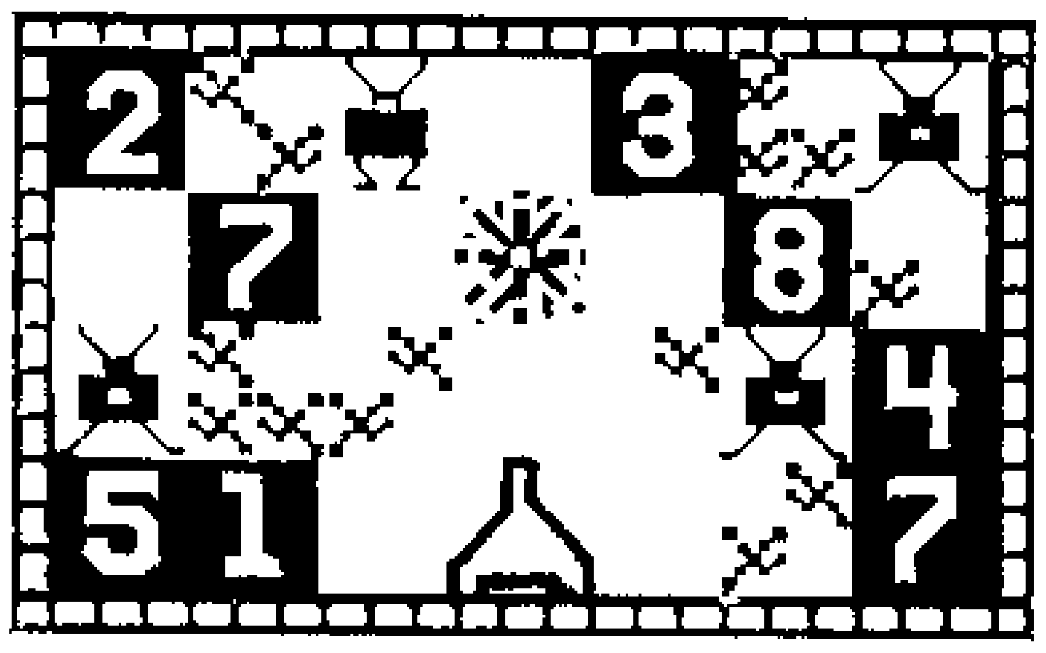

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PHM 3022	Personal Real Estate (Data storage system is recommended)	69.95	56.00
PHM 3044	Personal Report Generator (Data storage system is recommended)	49.95	40.00
PHM 3111	TI Writer (32K Memory Expansion required)	99.95	75.00
PHM 3113	Microsoft™ Multiplan™ (32K Memory Expansion required)	99.95	75.00
	Diskette		
PHD 5001	Mailing List	69.95	56.00
PHD 5003	Personal Financial Aids	19.95	16.00
PHD 5021	Checkbook Manager	19.95	16.00
PHD 5022	Business Aids Library - Finance Management (Extended BASIC Command Module is required)	39.95	32.00
PHD 5024	Business Aids Library—Inventory Management (Personal Record Keeping or Statistics Command Module is required)	69.95	56.00
PHD 5027	Business Aids Library—Invoice Management (Personal Record Keeping or Statistics Command Module is required)	69.95	56.00
PHD 5029	Business Aids Library—Cash Management (Extended BASIC Command Module is required)	39.95	32.00
PHD 5038	Business Aids Library—Lease/Purchase Decisions	69.95	56.00
	Cassette		
PHT 6003	Personal Financial Aids	14.95	12.00
PHT 6038	Business Aids Library - Lease/Purchase Decisions	59.95	45.00
Documentation Section for Young Minds			
PHA 2606	Creative Programming Computer Competency Series—Volume 1	9.95	8.00
PHA 2607	Creative Programming Computer Competency Series—Volume II	9.95	8.00
PHA 2608	Creative Programming Computer Competency Series—Volume III	9.95	8.00
PHA 2609	Creative Programming Computer Competency Series—Allstar Projects	9.95	8.00
Educational/Personal Enrichment			
	Command Modules		
DLM Arcademics			
PHM 3114	Alligator Mix††††	39.95	32.00
PHM 3116	Demolition Division	39.95	32.00
PHM 3118	Minus Mission††††	39.95	32.00
Texas Instruments Packages			
PHM 3002	Early Learning Fun	29.95	24.00
PHM 3003	Beginning Grammar	29.95	24.00
PHM 3004	Number Magic	19.95	16.00
PHM 3005	Video Graphs	19.95	16.00
PHM 3008	Video Chess	69.95	56.00
PHM 3010	Physical Fitness	29.95	24.00
PHM 3020	Music Maker (Data storage system is recommended)	39.95	32.00
PHM 3021	Weight Control and Nutrition (Data storage system is recommended)	59.95	48.00
PHM 3040	TI LOGO (Memory Expansion is required)	129.95	75.00
PHM 3064	Touch Typing Tutor* (Available for TI-99/4A only)	39.95	32.00
PHM 3109	TI Logo II* (32K Memory Expansion is required)	129.95	75.00
Scott, Foresman Reading and Math Packages (Developed by Scott, Foresman)			
PHM 3015	Early Reading (Solid State Speech™ Synthesizer is required)	54.95	44.00
PHM 3043	Reading Fun (Solid State Speech™ Synthesizer is recommended)	54.95	44.00
PHM 3046	Reading On	54.95	44.00
PHM 3047	Reading Roundup	54.95	44.00
PHM 3048	Reading Rally	54.95	44.00
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PHM 3028	Addition and Subtraction II (Solid State Speech™ Synthesizer is recommended)	39.95	32.00
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PHM 3049	Division I (Solid State Speech™ Synthesizer is recommended)	39.95	32.00
PHM 3050	Numerations I	39.95	32.00
PHM 3051	Numerations II	39.95	32.00
Scholastic Packages (Developed by Scholastic, Inc.)			
PHM 3059	Scholastic Spelling—Level 3 (Solid State Speech™ Synthesizer is required)	59.95	48.00
PHM 3060	Scholastic Spelling—Level 4 (Solid State Speech™ Synthesizer is required)	59.95	48.00
PHM 3061	Scholastic Spelling—Level 5 (Solid State Speech™ Synthesizer is required)	59.95	48.00
PHM 3062	Scholastic Spelling—Level 6 (Solid State Speech™ Synthesizer is required)	59.95	48.00

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Addison-Wesley Computer Math Games (Developed by Addison-Wesley Publishing Co.)			
PHM 3083	Computer Math Games II	39.95	32.00
PHM 3088	Computer Math Games VI	39.95	32.00
Milliken Home Math Series—K thru 8th grade (Developed by Milliken Publishing Co.)			
PHM 3090	Addition*	39.95	32.00
PHM 3091	Subtraction*	39.95	32.00
PHM 3092	Multiplication*	39.95	32.00
PHM 3093	Division*	39.95	32.00
PHM 3094	Integers*	39.95	32.00
PHM 3095	Fractions*	39.95	32.00
PHM 3096	Decimals*	39.95	32.00
PHM 3097	Percents*	39.95	32.00
PHM 3098	Number Readiness	39.95	32.00
PHM 3099	Laws of Arithmetic	39.95	32.00
PHM 3100	Equations	39.95	32.00
PHM 3101	Measurement Formulas	39.95	32.00
	Diskette		
Texas Instruments Packages			
PHD 5007	Teach Yourself BASIC	34.95	28.00
PHD 5009	Music Skills Trainer	29.95	24.00
PHD 5011	Computer Music Box	19.95	16.00
PHD 5018	Market Simulation	19.95	16.00
PHD 5019	Teach Yourself Extended BASIC (Extended BASIC Command Module is required)	24.95	20.00
PHD 5020	Music Maker Demonstration (Music Maker Command Module is required)	14.95	12.00
PHD 5023	Basketball Statistics (Extended BASIC Command Module is required)	24.95	20.00
PHD 5026	Bridge Bidding I	29.95	24.00
PHD 5030	Speak & Spell™ Program (Solid State Speech™ Synthesizer is required)	29.95	24.00
PHD 5031	Speak & Math™ Program (Solid State Speech™ Synthesizer and Terminal Emulator II are required)	29.95	24.00
PHD 5039	Bridge Bidding II	29.95	24.00
PHD 5041	Bridge Bidding III	29.95	24.00
PHD 5042	Speller Writer (Terminal Emulator II Command Module and Solid State Speech™ Synthesizer are required)	29.95	24.00
PHD 5067	Beginner's BASIC/Tutor	29.95	24.00
MECC Packages (Developed by Minnesota Educational Computing Consortium)			
PHD 5078	Metric and Counting* (Extended Basic Command Module is required)	29.95	24.00
PHD 5079	Elementary Economics*	29.95	24.00
PHD 5080	Elementary Math and Science* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5081	Astronomy* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5082	Word Beginnings* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5083	Exploring* (Extended BASIC Command Module is required)	29.95	24.00
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Education/Personal Enrichment Continued			
PHD 5085	Science Facts* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5086	Natural Science* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5087	Social Science* (Extended BASIC Command Module is required)	29.95	24.00
PHD 5088	Teacher's Tool Box* (Extended BASIC Command Module and printer are required)	29.95	24.00
	Cassette		
PHT 6007	Teach Yourself BASIC	29.95	24.00
PHT 6009	Music Skills Trainer	24.95	20.00
PHT 6011	Computer Music Box	14.95	12.00
PHT 6018	Market Simulation	14.95	12.00
PHT 6019	Teach Yourself Extended BASIC (Extended BASIC Command Module is required)	19.95	16.00
PHT 6026	Bridge Bidding I	24.95	20.00
PHT 6031	Speak & Math™ Program (Solid State Speech™ Synthesizer and Terminal Emulator II are required)	24.95	20.00
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Entertainment			
	Command Modules		
Texas Instruments Packages			
PHM 3009	Football	29.95	24.00
PHM 3018	Video Games I	29.95	24.00
PHM 3023	Hunt the Wumpus	24.95	20.00
PHM 3024	Indoor Soccer	29.95	24.00
PHM 3025	Mind Challengers	24.95	20.00
PHM 3030	A-Maze-Ing	24.95	20.00
PHM 3052	Tombstone City 21st Century	39.95	32.00
PHM 3053	TI Invaders	39.95	32.00
PHM 3054	Car Wars	39.95	32.00
PHM 3057	Munch Man	39.95	32.00
PHM 3042D	Tunnels of Doom (2 Diskette Games Included)	59.95	45.00
PHM 3042T	Tunnels of Doom (2 Cassette Games Included)	59.95	45.00
PHM 3056	Alpiner**	39.95	32.00
PHM 3110	Chisholm Trail	39.95	32.00
PHM 3112	Parsec*	39.95	32.00
Milton Bradley Packages (Developed by Milton Bradley Company)			
PHM 3031	The Attack††	39.95	32.00
PHM 3032	Blasto††	24.95	20.00
PHM 3033	Blackjack and Poker††	24.95	20.00
PHM 3034	Hustle††	24.95	20.00
PHM 3036	ZeroZap††	19.95	16.00
PHM 3037	Hangman††	19.95	16.00
PHM 3038	Connect Four††	19.95	16.00
PHM 3039	Yahtzee††	24.95	20.00
Adventure International Packages (Developed by Scott Adams)			
PHM 3041D	Adventure (Pirate Adventure Diskette Game Included)	49.95	40.00
PHM 3041T	Adventure (Pirate Adventure Cassette Game Included)	49.95	40.00
Gabriel Industries Packages (Developed by Gabriel Industries)			
PHM 3067	Othello† (Developed by Gabriel Industries)	39.95	32.00
	Diskette		
Texas Instruments Packages			
PHD 5002	TI-Trek (with optional speech)	14.95	12.00
PHD 5010	Mystery Melody	14.95	12.00

Model	Name	Mfr. Sugg. Ret.	Elek-Tek Price
PHD 5015	Oldies But Goodies—Games I	19.95	16.00
PHD 5017	Oldies But Goodies—Games II	24.95	20.00
PHD 5025	Saturday Night Bingo (Solid State Speech™ Synthesizer is required)	29.95	24.00
PHD 5037	Draw Poker (Extended BASIC Command Modules is required)	24.95	20.00
PHD 5057	Tombstone City 21st Century (32K Memory Expansion and Extended BASIC Command Module are required)	19.95	16.00
PHD 5058	TI Invaders (32K Memory Expansion and Either Extended BASIC or Editor/Assembler Command Module are required)	19.95	16.00
PHD 5060	Munch Man (32K Memory Expansion and Either Extended BASIC or Editor/Assembler Command Module are required)	19.95	16.00
Adventure International Adventure Series (Developed by Scott Adams) (PHM 3041D required)			
PHM 5046	Adventureland	29.95	24.00
PHD 5047	Mission Impossible	29.95	24.00
PHD 5048	VooDoo Castle	29.95	24.00
PHD 5049	The Count	29.95	24.00
PHD 5050	Strange Odyssey	29.95	24.00
PHD 5051	Mystery Fun House	29.95	24.00
PHD 5052	Pyramid of Doom	29.95	24.00
PHD 5053	Ghost Town	29.95	24.00
PHD 5054	Savage Island I & II	39.95	32.00
PHD 5056	Golden Voyage	29.95	24.00
	Cassette		
Texas Instruments Packages			
PHT 6010	Mystery Melody	9.95	9.00
PHT 6015	Oldies But Goodies—Games I	14.95	12.00
PHT 6017	Oldies But Goodies—Games II	19.95	16.00
PHT 6025	Saturday Night Bingo (Solid State Speech™ Synthesizer is required)	24.95	20.00
PHT 6037	Draw Poker	19.95	16.00
Adventure International Adventure Series (Developed by Scott Adams) (PHM 3041T required)			
PHT 6046	Adventureland	29.95	24.00
PHT 6047	Mission Impossible	29.95	24.00
PHT 6048	Voodoo Castle	29.95	24.00
PHT 6049	The Count	29.95	24.00
PHT 6050	Strange Odyssey	29.95	24.00
PHT 6051	Mystery Fun House	29.95	24.00
PHT 6052	Pyramid of Doom	29.95	24.00
PHT 6053	Ghost Town	29.95	24.00
PHT 6054	Savage Island I & II	39.95	32.00
PHT 6056	Golden Voyage	29.95	24.00
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	Command Modules		
PHM 3001	Demonstration	69.95	56.00
PHM 3011	Speech Editor (Solid State Speech™ Synthesizer is required)	44.95	36.00
PHM 3014	Statistics (Data storage system is recommended)	44.95	36.00
PHM 3026	Extended BASIC	99.95	75.00
PHM 3035	Terminal Emulator II	49.95	40.00
PHM 3055	Editor/Assembler	99.95	80.00
PHM 3058	Mini-Memory (4K)	99.95	80.00
PHM 3045D	SMU Electrical Engineering Library• (2 Diskettes included)	149.95	120.00
PHM 3045T	SMU Electrical Engineering Library• (10 Cassettes included)	149.95	120.00
	Diskette		
PHD 5004	Programming Aids I	14.95	12.00
PHD 5005	Programming Aids II	24.95	20.00
PHD 5006	Math Routine Library	29.95	24.00
PHD 5008	Electrical Engineering Library	29.95	24.00
PHD 5012	Programming Aids III	19.95	16.00
PHD 5013	Graphing Package	19.95	16.00
PHD 5016	Structural Engineering Library	29.95	24.00
PHD 5044	AC Circuit Analysis	29.95	24.00
PHD 5063	UCSD-PASCAL» Compiler (32K Memory Expansion and P-Code required)	124.95	100.00
PHD 5064	UCSD p-System» Assembler/Linker (32K Memory Expansion and P code required)	99.95	80.00
PHD 5065	UCSD p System» Editor/Filer/Utilities (32K Memory Expansion and P-code required)	74.95	60.00
PHD 5066	TI PILOT (32K Memory Expansion and P-code required)	79.95	60.00
PHD 5068	Course Designer Authoring Package (Extended BASIC required and Video Controller optional)	199.95	150.00
PHD 5075	Text-To-Speech (English) a (Solid State Speech™ Synthesizer, 32K Memory Expansion and Extended BASIC Command Module are required)	29.95	24.00
	Cassette		
PHT 6004	Programming Aids I	9.95	9.00
PHT 6006	Math Routine Library	24.95	20.00
PHT 6008	Electrical Engineering Library	24.95	20.00
PHT 6013	Graphing Package	14.95	12.00
PHT 6016	Structural Engineering Library	24.95	20.00
PHT 6044	AC Circuit Analysis	24.95	20.00
SOFTWARE LIBRARIES			
PHL 7001	The Home Financial Manager	139.95	100.00
PHL 7002	The Family Entertainer	89.95	65.00
PHL 7003	The Elementary Educator	99.95	75.00
PHL 7004	The Music Educator	64.90	50.00
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PHL 7010	The Milton Bradley Game Series	114.75	90.00
PHL 7011	The Computer Introductory Package	119.85	90.00

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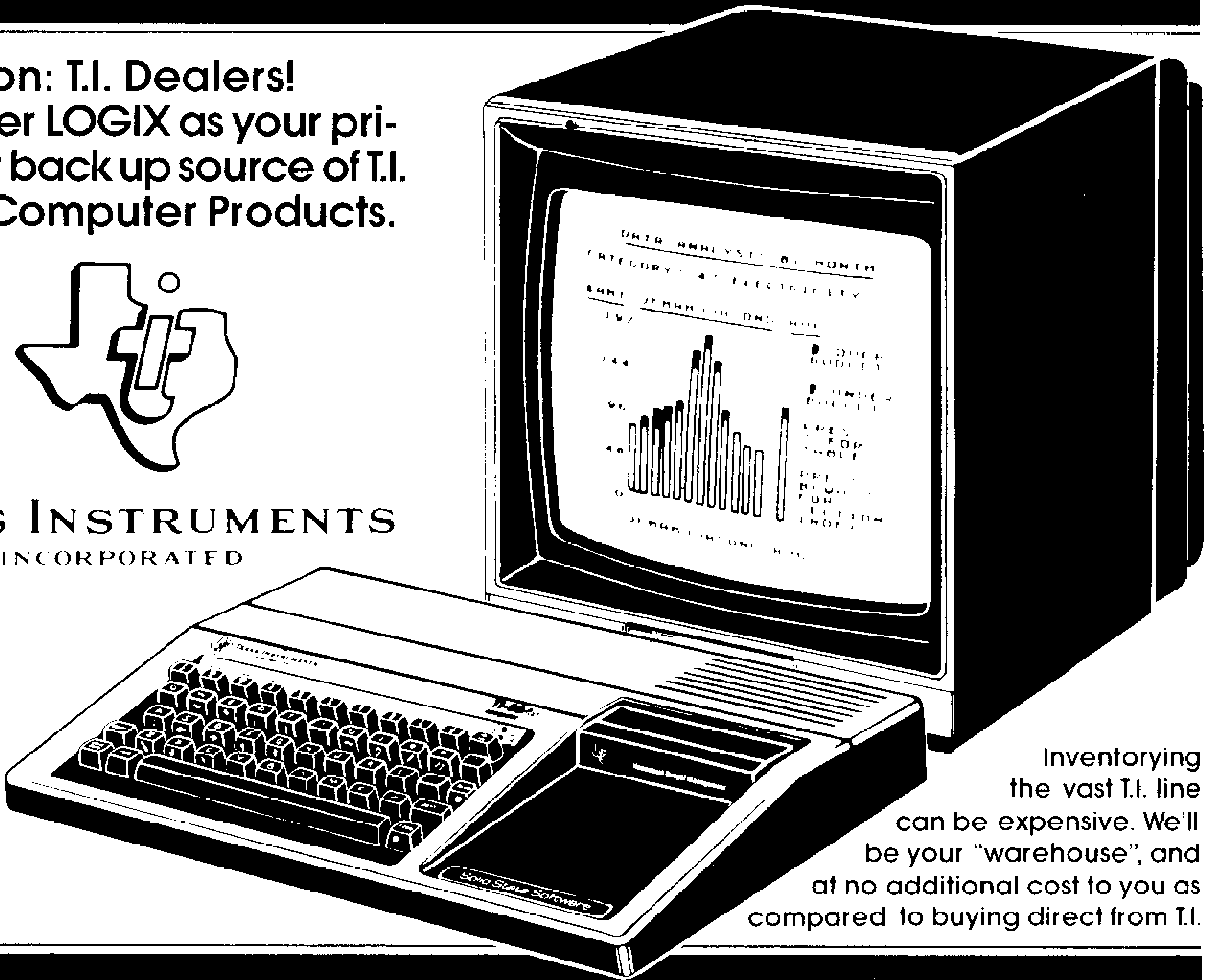

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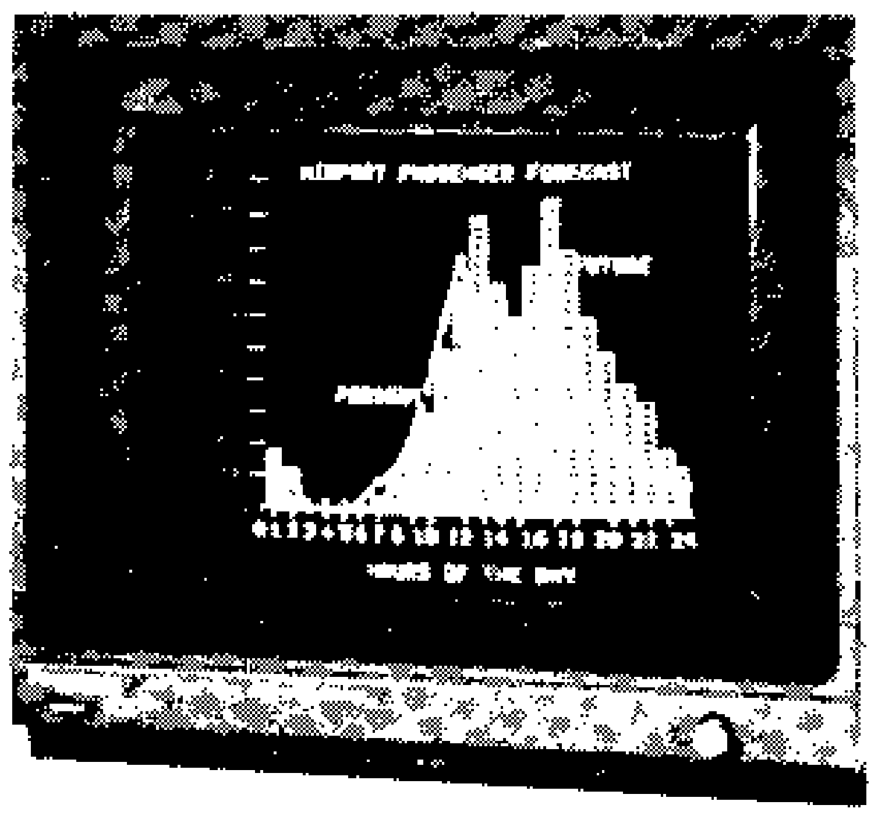

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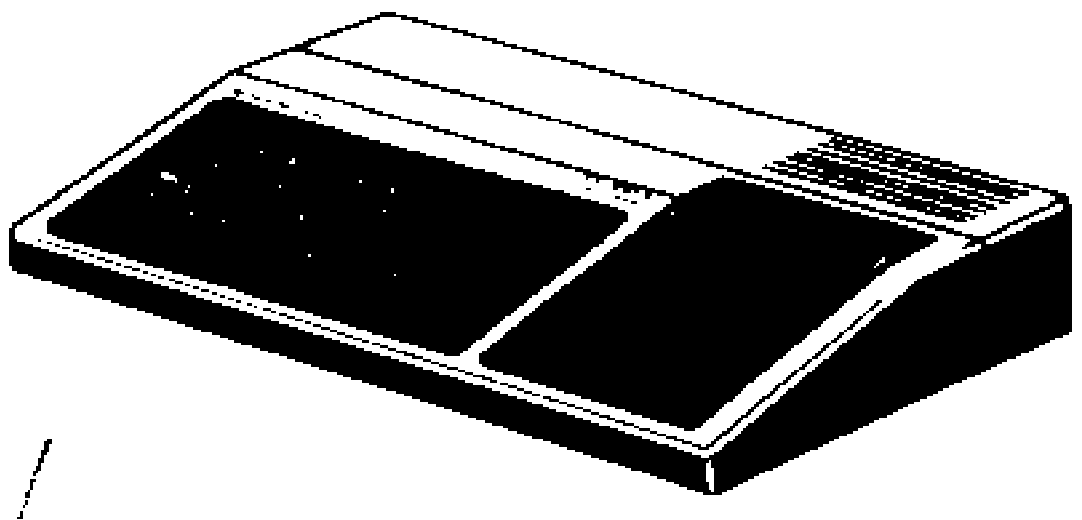

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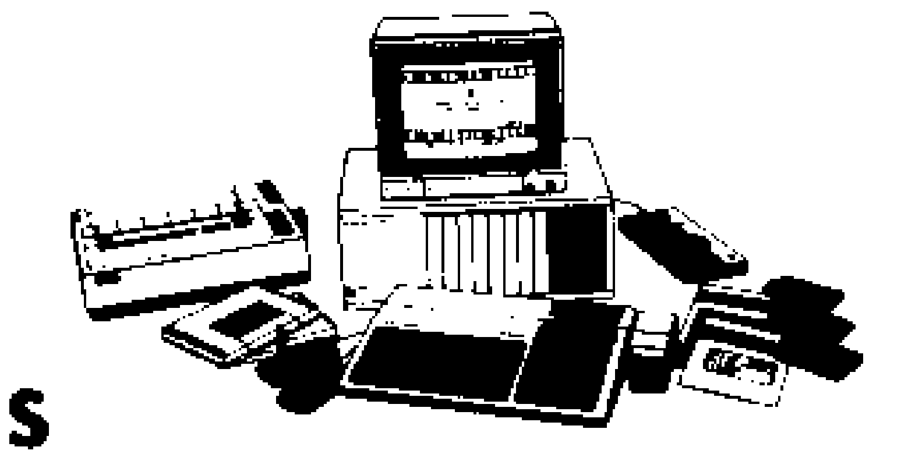

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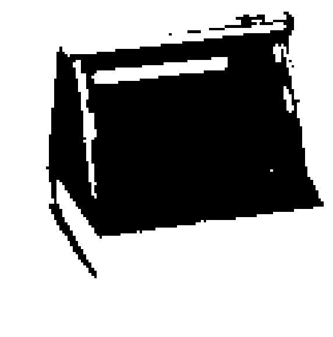

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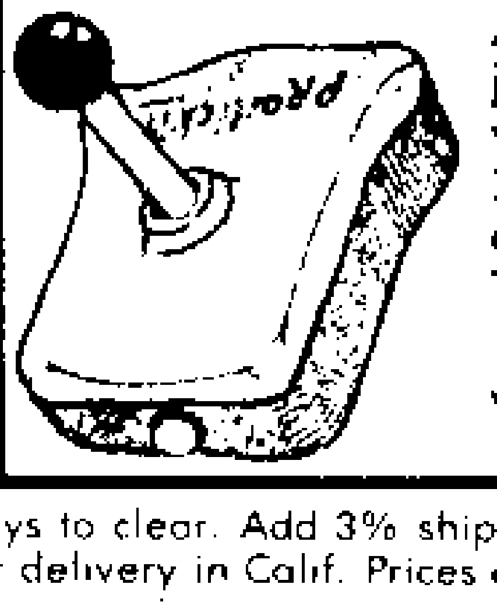

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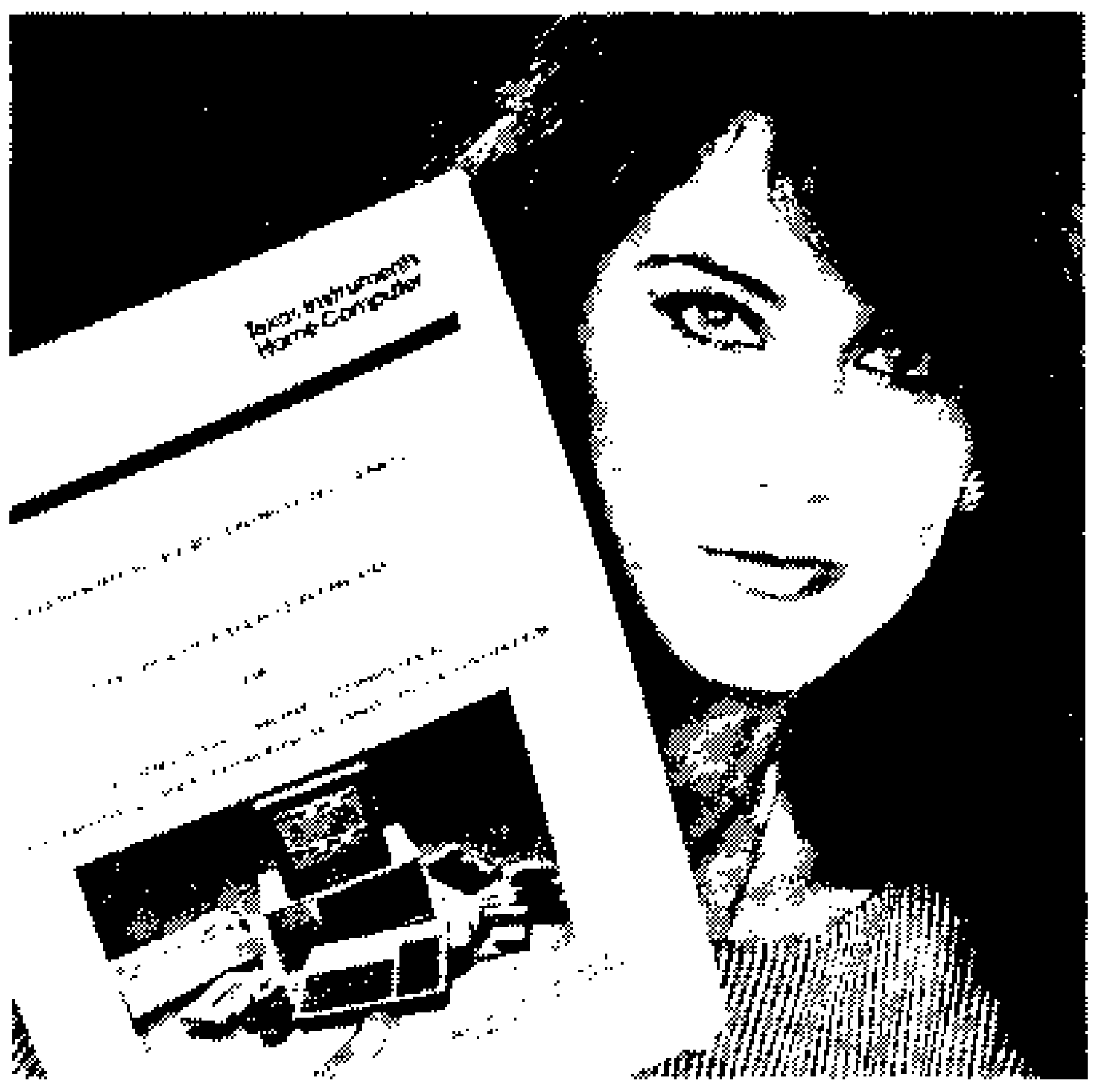

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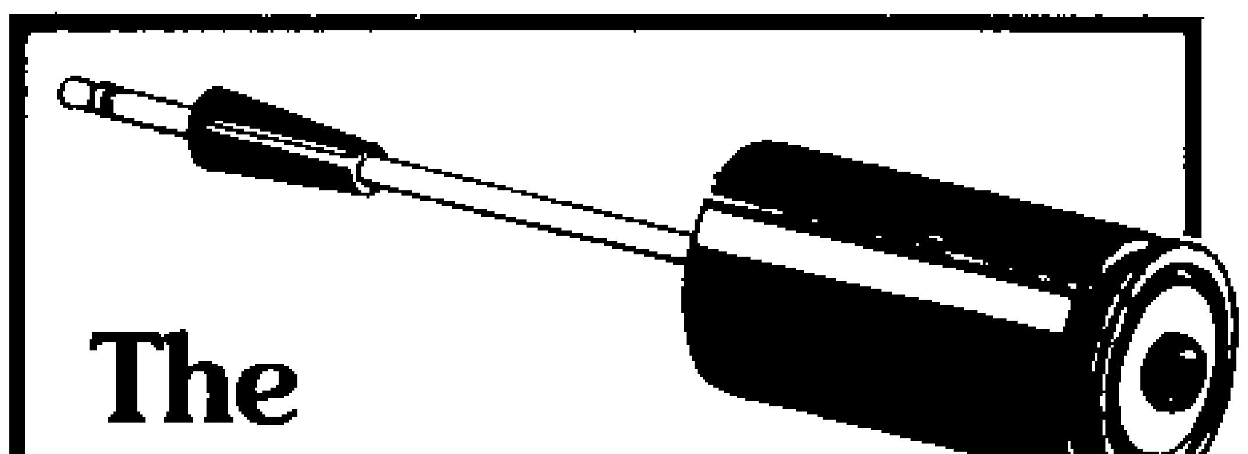

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LETTERS on LOGO

Dear Sir,

We have been using TI LOGO since the fall of 1981 in an elementary special education classroom. This has been an exciting experience for both the youngsters and ourselves. We selected TI LOGO because it was the only version of LOGO available on a microcomputer at the time we purchased it.

The August, 1982 issue of BYTE Magazine featured LOGO. This issue was certainly of great value to us. In particular, a paper by Gregg Williams (page 230) contained an informative comparison of LOGO for the Apple II, the TI-99/4A and the TRS80 Color Computer. However, we feel that he was not quite fair to TI LOGO. We have suggested the following corrections which may also be of interest to your readers:

(1) Williams's discussion of the "word/number dichotomy" notes that words and numbers are not interchangeable in TI LOGO as they are in Apple LOGO. However, in TI LOGO, prefixing a number with a *quote symbol* allows the number to be used as a word. Williams gives the Apple LOGO example:

```
  MAKE “NUM1 14
  MAKE “VAR1 WORD “XXX
    :NUM1
  PRINT :VAR1
```

The output produced is:

```
  XXX14
```

TI LOGO will give an error message for this sequence of commands. However, the following TI LOGO sequence of commands will produce the same result as the above Apple version:

```
  MAKE “NUM1 “14
  MAKE “VAR1 WORD “XXX
    :NUM1
  PRINT :VAR1
```

(2) There is no command in TI LOGO to convert a number to its character equivalent. This is the "hole in the (TI LOGO) instruction set" alluded to in Williams's paper. However, this "hole" can readily be filled for non-negative integers by defining function CHAR :N to perform this conversion as follows:

```
TO CHAR :N
  CHARRQ :N MAKE “X CHARP
    :CHARR
  TEST :CHARQ=0 IFF CHARC
    :CHARQ
  IFT OUTPUT :X
  END
TO CHARRQ :N
  MAKE “CHARQ :N/10
  MAKE “CHARR :N—:CHARQ*10
  END
TO CHARP :R
  MAKE “CHARU “0123456789
  REPEAT :R [MAKE “CHARU BF
    :CHARU]
  OUTPUT FIRST :CHARU
  END
TO CHARC :N
  CHARRQ :N MAKE “X WORD
    (CHARP :CHARR) :X
  TEST :CHARQ=0 IFF CHARC
    :CHARQ
  END
```

(3) To obtain an estimate of workspace size, one of the procedures defined by Williams for Apple (Terripin/Krell) LOGO follows:

```
TO FILLPROC :N
  PRINT 1 [AT LEVEL] PRINT :N
  MAKE“PROCNAME WORD “P
    :N
  DEFINE :PROCNAME [ [ ] ]
  FILLPROC :N+1
  END
```

The FILLPROC procedure defined by Williams for TI LOGO follows:

```
TO FILLPROC :N
  TYPE [AT LEVEL] PRINT :N
  MAKE “PROCNAME WORD “P
    PICK :N :QQ
  DEFINE :PROCNAME [ [ ] ]
  FILLPROC :N+1
  END
```

Along with the additional procedure:

```
TO PICK :N :WORD
  IF :N = 1 THEN OUTPUT FIRST
    :WORD
  OUTPUT PICK :N - 1 BUTFIRST
    :WORD
  END
```

These are to be executed after setting up QQ using:

```
TO MAKEQQ
  MAKE “QQ
  “1234567890ABCDEFGHIJKLMN
    OPQRSTUVWXYZ
  END
```

Actually, this version of FILLPROC for the TI will hang up at level 11, because at that level PA is generated to be used as a procedure name. This is forbidden. PA is a system command in LOGO. A, N, O and P should all be omitted from the character string in Williams's MAKEQQ procedure so that FILLPROC will not hang up trying to redefine system commands. Using the function CHAR :N defined in (2) above, a FILLPROC procedure that produces the same sequence of procedures (including the same names) for the TI as Apple II's version follows:

```
TO FILLPROC :N
  TYPE [AT LEVEL] PRINT :N
```

Continued on p. 48

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THE P-CODE/PEGASUS CONNECTION

The Data Systems Group (DSG) of Texas Instruments, headquartered in Austin, is finally getting into the personal computing act with their Professional Computer--an "IBM PC-compatible machine" known within the company as "Pegasus." This marks the first time that TI isn't using one of their own integrated circuits as CPU. The Intel 8088 will be the machine's microprocessor--giving it the ability to use the prodigious amount of software developed to run (sometimes with slight modification) under the IBM operating system (actually Microsoft's MS-DOS). Additionally, the machine will be equipped to run Digital Research CP/M-86 and Concurrent CP/M-86, plus the UCSD p-System--TI's first choice for a portability standard. This is significant to 99/4A Home Computer users in that much more p-System software should finally be migrating over to the Lubbock-produced 99/4A and its future offspring.

SOPHISTICATED DBMS NOT YET QUITE AT HOME

The availability of TI-Writer and Multiplan for the Home Computer serves to underscore the need for a more sophisticated, yet user-friendly data base management system (DBMS) than TI's own Personal Record Keeping (PRK) Command Cartridge--especially now that files created with Multiplan can be used with TI-Writer. One obvious candidate is PFS and PFS Report written in p-Code and presently very popular on the Apple--with over 100,000 units sold. Since TI's Austin-based DSG is making PFS one of the initial products available on the Pegasus (see above), chances are very good that Lubbock's Personal Computer Division will also opt for it--but perhaps with a file conversion utility for use with TI-Writer and Multiplan.

HEX-BUS DRIVES HOME A TRUCKLOAD OF POSSIBILITIES

With TI's CES announcement that an optical wand reader, modem, and printer would be added to its new line of compact peripherals--i.e., Wafertape Drive, RS-232, 4-Color Printer/Plotter--industry analysts are wondering if a 3" floppy disk drive is far behind . . . But why stop there? The new standard TI bus is really a speculator's delight--the proverbial "stuff that dreams are made of." Visions of optical disks, home control devices, and bartending robots are all within the realm of possibility . . .

PRICE PLUMMETS ON HOME COMPUTER

As a result of the Texas Instruments early-February drop in dealer price on the 99/4A Home Computer, the average "street price" for the popular unit (after rebate) has fallen 25%. The new price point helps to strengthen the unit's price/performance position against competition from other manufacturers --most notably Commodore. The move is also seen as a catalyst to keep up sales momentum during the notoriously slow retailing months of February and March.

THIRD-PARTY DOOR OPENED ON COMPACT SERIES

TI has demonstrated a commitment to the portable computing market with its recent introduction of the Compact Computer 40 (CC-40) and announced series of more sophisticated compacts that will follow. The availability of two hard/soft wares in particular signifies an open door to third-party developers who want a piece of the portable pie. The Wafertape Digital Drive offers inexpensive random access for relatively rapid file management capability, and the Editor/Assembler cartridge provides another relatively inexpensive tool for assembly language software development. Although the tools are in place, software development will be slow at first--tied to a traditional learning curve--due to TI's choice of microprocessor chip--the TMS70C20, a CMOS member of the TMS7000 series family with an architecture and instruction set different from the well-known 9900 series.

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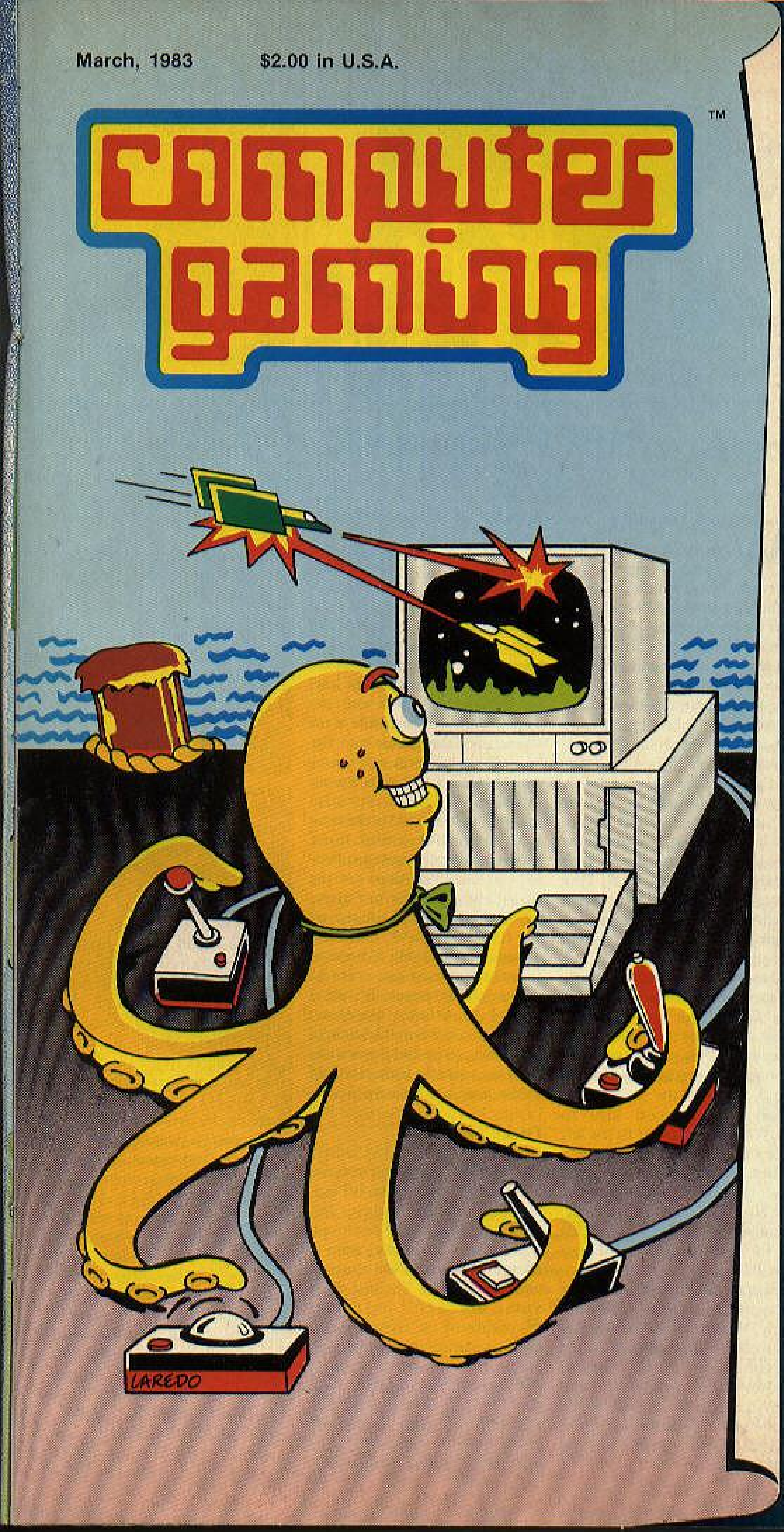

Joystick Jockey

By 99'er HCM Staff

Joysticks have been around a long time—long before the first computer. Airplane pilots have been using them since the beginnings of flight. Back then, a joystick was no more than a metal rod coming out of the cockpit floor, and it gave the pilot control over the aircraft. As for the origin of the term "joystick," it is apparently so named because of the *joy* that comes with controlling the plane.

When computer game joysticks first appeared on the market, there were only one or two varieties to choose from. But in recent years virtually every product associated with the computer has experienced a massive proliferation of new models and types, and the joystick is no exception. Today's computer game player can select from a broad range of joystick models—analog joysticks, table-top models, hand-held varieties, or even a rolling ball type of controller. With such a wide selection available, it makes sense to do a little comparison shopping before purchasing one.

> **"Before you buy: take it for a test drive, run the course, and see how it handles."**

If you are serious about computer gamesmanship, the joystick may be one of the most important peripherals you'll ever purchase. Before you make a decision, take into account some of the models, colors, and options out there. Buy your first joystick the way you'd buy a car: Take it for a test drive, run the course, and see how it handles. Once you've tried a number of sticks, choose the one that works best for *you*. There are several factors that will influence your decision.

How Does It Handle

First of all, if you want a joystick that fits in your hand, allowing you to sit back in your favorite chair while blasting those pesky aliens, a hand-held model such as the TI joystick may be your best bet.

In selecting a hand-held joystick, comfort in handling should be your main consideration. Check to see how the joystick feels—is it too heavy or light? And how well does it fit in your hand? Do you have to practice palming a basketball for a week before you can master the joystick? The base should be small enough for you to get a good grip, but large enough to hold onto when you fire. The size of the joystick

Continued on p. 48

computer gaming™

Computer Gaming is a magazine for all game lovers—players, designers, and programmers of microcomputer games. Regular features include product reviews, letters to the editor, player strategy, a question and answer forum, a Hall of Fame for high scorers, tutorial articles on game design and programming, plus interviews with professionals in the world of computer gaming.

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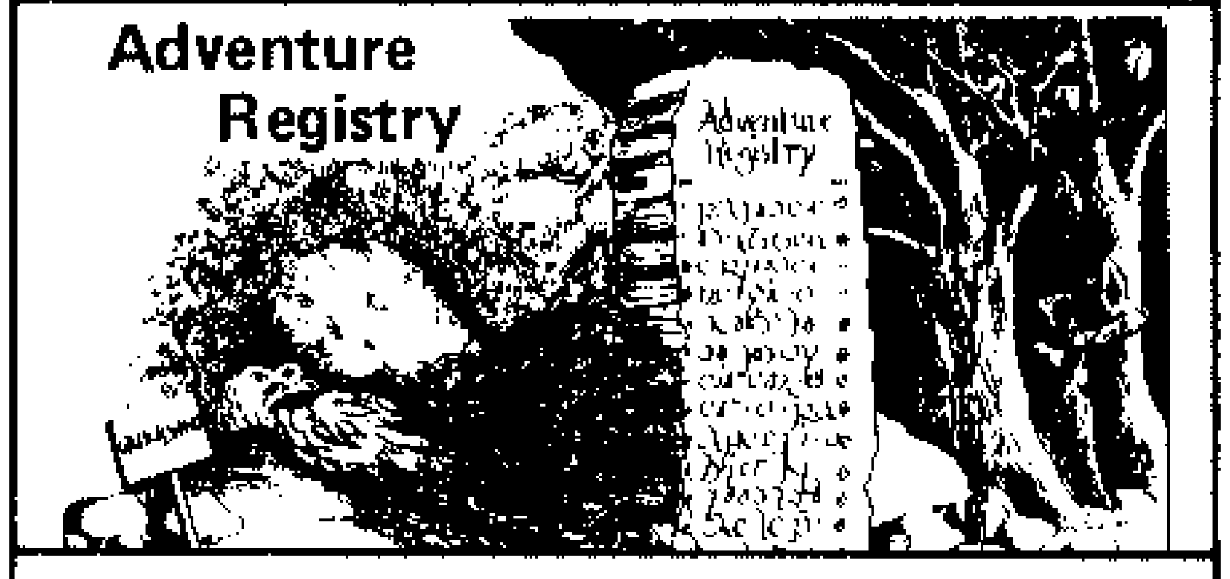
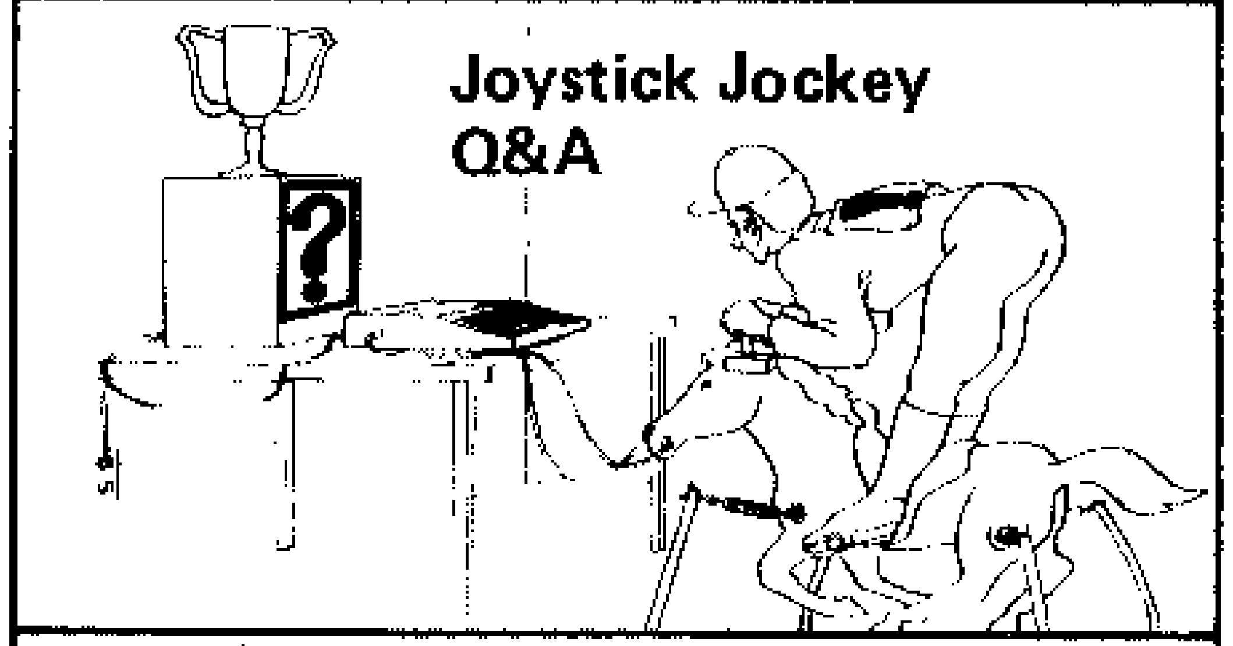
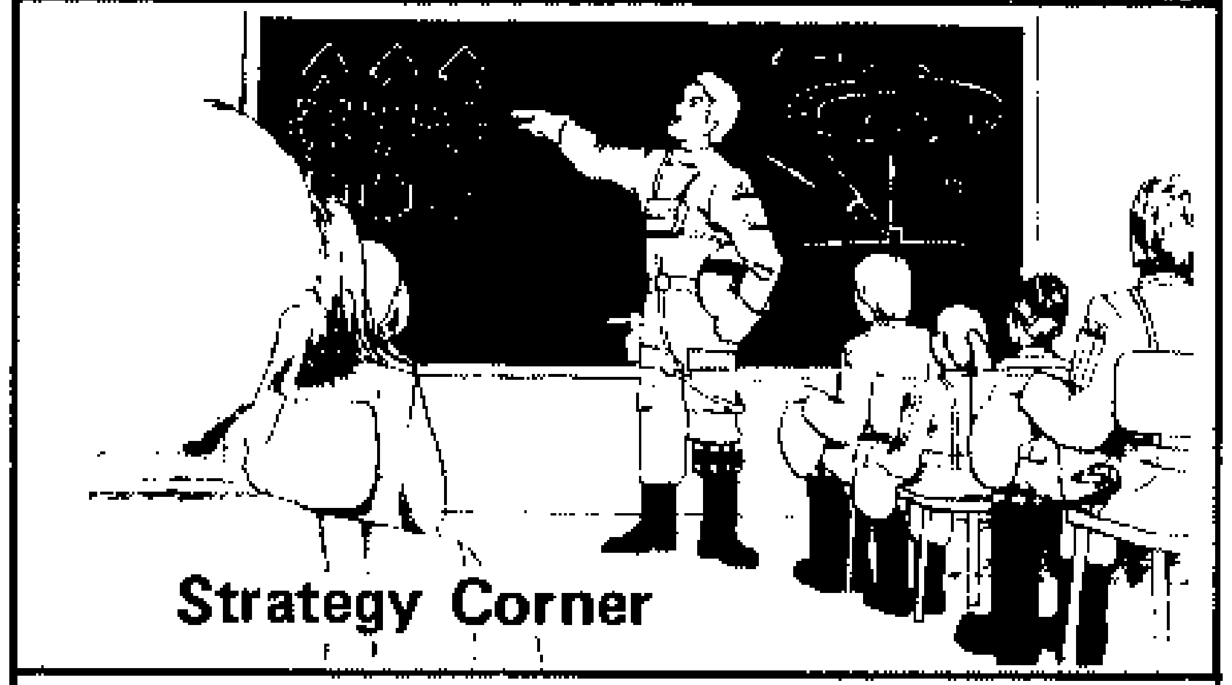
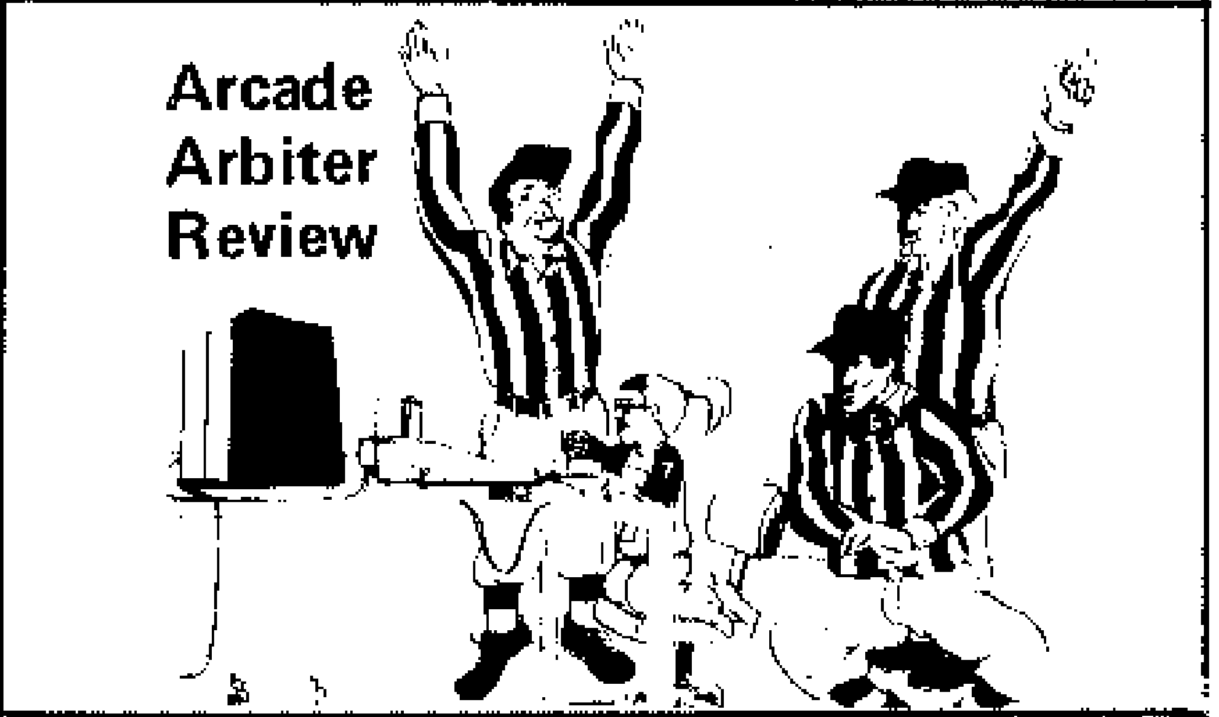
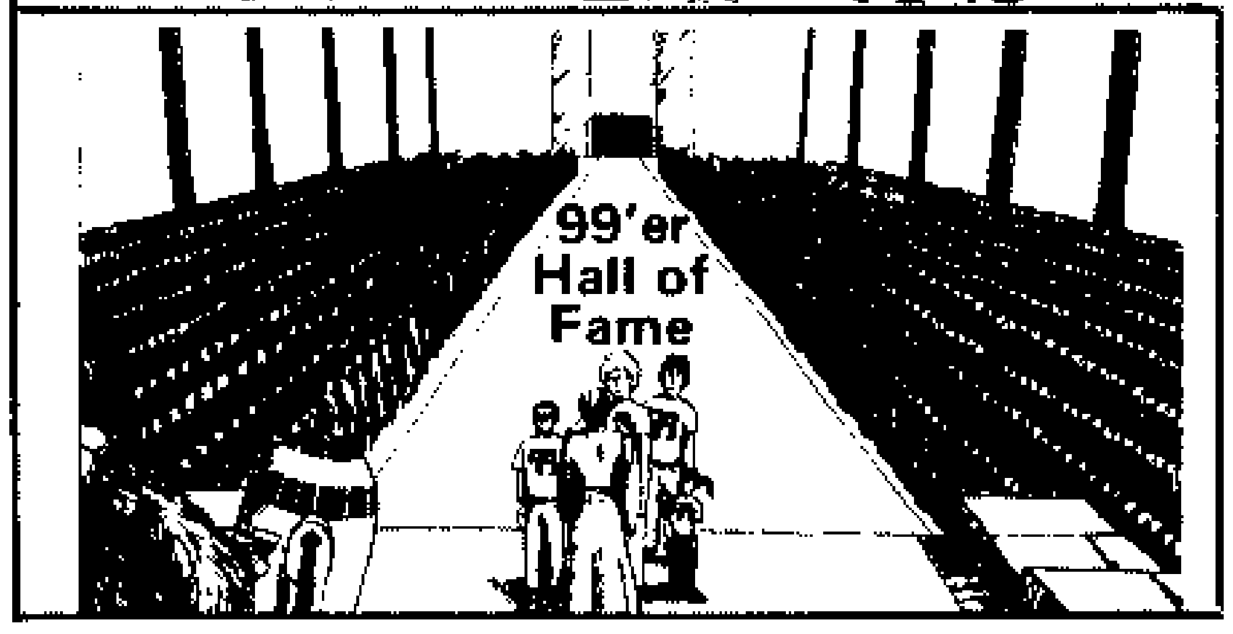


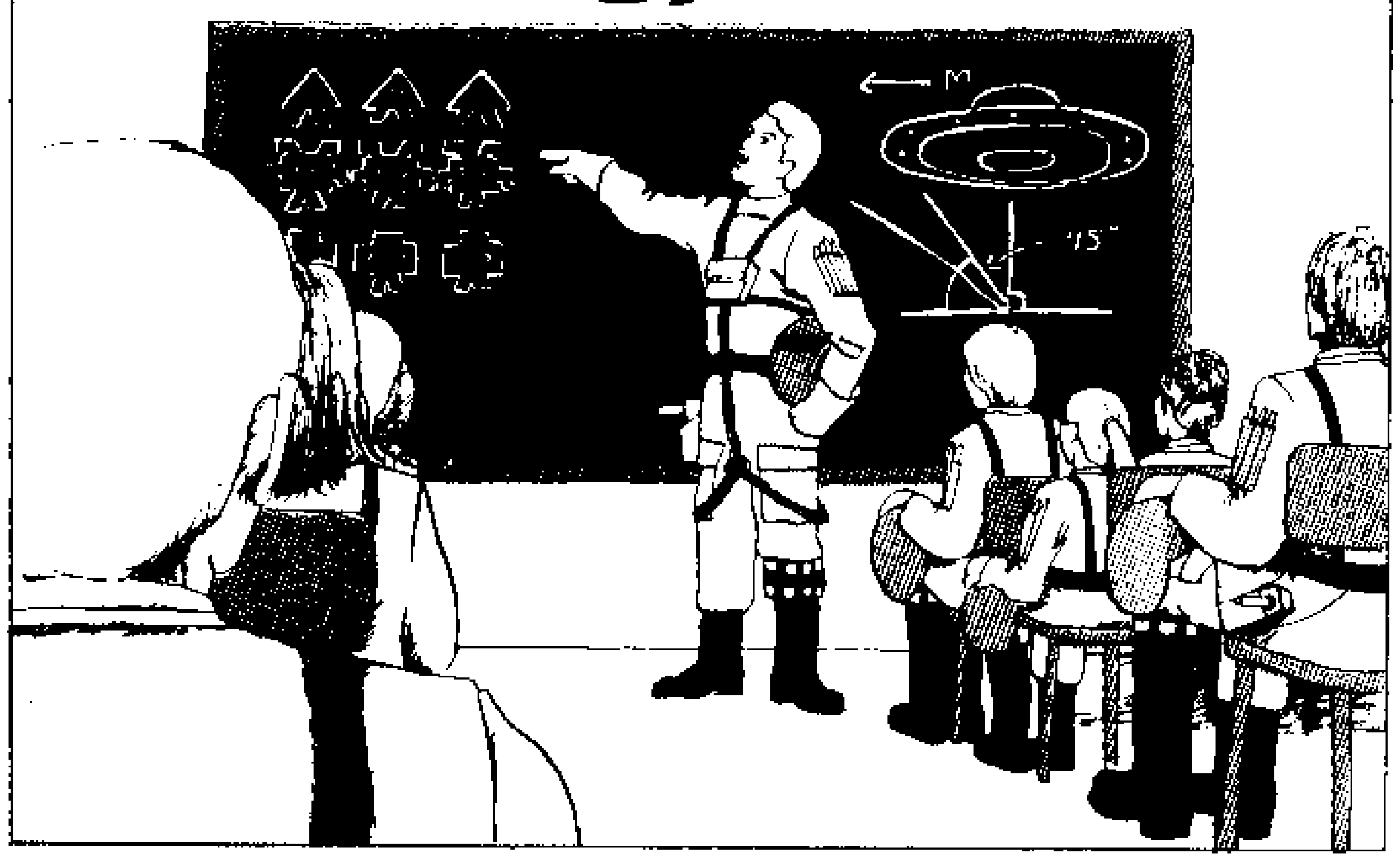








Strategy Corner



Parsec

By Bob Gagle

1475 Evalie Drive
Fairfield, OH 45014

Winning at *Parsec* requires more than just flying through a few asteroid belts, landing in the refueling tunnel and knocking off every alien fighter or cruiser you come across. To be a true *Parsec* master you need good eye-hand coordination, quick reflexes, and most important—a winning strategy. The following is a careful analysis of each of the *Parsec* enemies—their individual habits and peculiarities—and a collection of tips for nailing the little nasties before they destroy you.

First, let's take a look at the Swoopers. These enemy craft look like large-winged jets. They come in all colors and enter from the top of the screen, increasing their speed as the game progresses.

Never underestimate the power of these ships. Although they will not *fire* at your craft, they do have a tendency to ram into their enemies. When you encounter a Swooper try to stay in the far left hand corner of the screen. (Actually, it's a good idea to ALWAYS stay as far to the left side of the screen as possible.) When battling Swoopers you want to move fast, so it is best to use lift 3. In later levels, however, it might be necessary to use lift 2 for more precise aiming capabilities.

Shaped like tiny bullets, the Urbites are armed with two cannons each. When these ships are announced, fly immediately to the extreme top of the screen. Because they follow your vertical movements only very slowly, just move and fire. Stay away from the bottom of the screen, and you will be safe.

A sleeker version of the Swooper, the LTF will emerge from the top of the screen and accelerate steadily. These multicolored ships also resemble the Swooper in that they will not fire upon you. Their speed changes, however, are much more dynamic. They like to fly low, forcing you to crash into the planet, so stay in the middle of the screen until they come up. The best lift for this level is 3, but be ready to change to 2 in dangerous situations.

Dramites look exactly the same as Urbites, but they track faster and have only one cannon. People say that these ships are the most deadly enemies in *Parsec*, but they can be easily destroyed by following these hints: 1) *Always* stay on lift 3 because Dramites are quite fast in tracking vertical movement. 2) Start as close to the surface of the planet as you can; 3) When the Dramite comes out, go up and down while firing occasionally, letting the ship follow you into your laser.

Tricky Saucers

In my opinion, it is the Saucers who are the trickiest adversaries because they come from behind, seemingly out of nowhere. But never fear, they *can* be destroyed. If you have four or more ships in reserve, the Saucers will attack in random patterns. The best thing to do is stay on lift 2, and fly near the middle of the screen. If you notice a particular group is coming from the top or bottom, wait until they have been destroyed, then move your ship near their source. If too many Saucers are on the screen, switch to lift 3. And be careful! Sometimes when you fire your laser at Saucers on lif 3, it will go between the ship and the exhaust. It you have three o less ships in reserve, the Saucers will attack in a pattern starting a the top of the screen and moving down.

Bynites are very similar to Urbites, and can be easily destroyed. Begin as close to the planet a possible, using lift 3. When th Bynite comes out, move all th way to the top of the screen; fir at it when it gets there and then move. It works every time!!

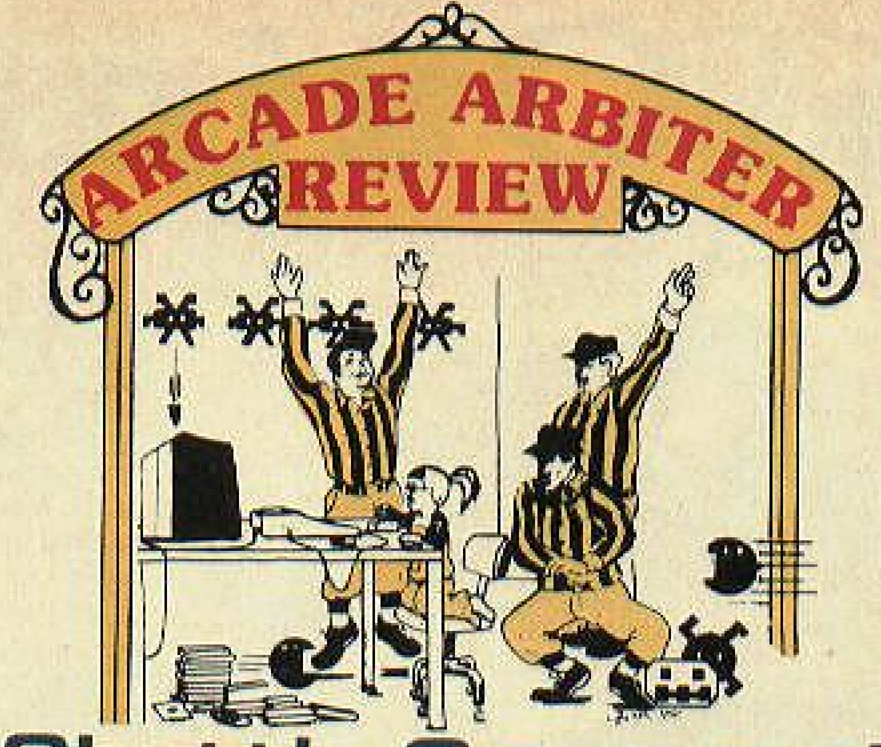
Killer Satellites will appear afte you complete the asteroid belt o level 4. Entering from all directions, moving erratically and firing frequently, these vicious foe are bent upon your destruction. They attack in random groups, a random speeds. The best strategy with these guys is to drop as far back as possible and use lift 3, because they are very unpredictable. There is no really sure way to destroy them.

Now that you are aware of your enemies' foibles and idiosyncracies, here are a few pointers to improve your own performance. When you are in the asteroid belt, *always* use lift 2, stay at the bottom of the screen, and fire continually at the lowest asteroid. That way, if you miss your target, you can dodge it and retreat to the protection of the planet. Occasionally, you may get trapped; if you get into trouble, use lift 3. And be wary of firing too much—overheating is very easy. Also, you should always use lift 1 in the refueling tunnel.

I have found that in playing *Parsec*, joysticks do not respond as well as the keyboard; therefore I use the keyboard with the following finger placement; LEFT HAND: Middle finger on E key, pointer finger on X key, pinky and ring fingers control the lift. RIGHT HAND: Pointer finger on the period key, middle finger controls pause (p key). For horizontal movement, I interchange the fingers on my left hand (on the E and X keys) to the S and D keys whenever needed. Always anticipate where the enemy is going, and stay calm while pressing the buttons on the keyboard. Remember that until you get accustomed to the keyboard, it will be difficult to play, because all it takes is a split second to get killed if you remove your eyes from the screen!

GOOD LUCK AND HAPPY PARSEC-ING!!!!!!!

99'er



Shuttle Command

Reviewed by Steve Schwartz

99'er Games Editor

Authors:	**R. Rothstein, F. Stellerine & F. Della Rossa**
Program Type:	**Battle in Space**
Language:	**Extended BASIC**
Distributor:	**FFF Software P. O. Box 4196 Trenton, NJ 08610**
Price:	**$17.50, cassette or disk**

As your television screen fills with stars, all it takes is a little imagination to mentally leap from your living room to the far reaches of space. The instrument panel and crosshairs that appear on screen transform your television into the cockpit of an advanced spacecraft—one that is said to be equipped with the most modern weapons of destruction. With joystick in hand, you hurtle through space ready to shoot down whatever, or whomever, gets in your way . . .

FFF Software has made a valiant attempt to simulate the excitement of gunning down enemy spacecraft in their Extended BASIC *Shuttle Command* program. The result, however, leaves something to be desired. Take, for example, the 3-dimensional enemy craft we are promised: The enemies do grow in size as they "approach" your ship—but this isn't what I would call a realistic 3-D graphic effect. I understand, of course, that you can't achieve the same graphic effects in Extended BASIC as in Assembly Language, but most buyers of computer games don't care about the limitations of the language—they just want to play a rousing good game.

Nevertheless, *Shuttle Command* does have several nice features that make it, perhaps, the best game of its type for the TI-99/4A. For example, if you shoot an enemy craft while it's still far away (and small), you get more points than if you wait until it gets closer. A nice arcade effect appears when you hit an enemy ship—the point value for your successful shot is momentarily displayed on the screen next to the explosion.

The instrument panel at the bottom of the screen shows you the amount of damage you've sustained and the level of energy you still have. If your damage reaches 100% or your energy level slips to zero, the window of your spacecraft shatters—leaving no doubt that the game is over. I also liked the way your spacecraft's damage is directly related to the severity of the enemy attack. If the enemy ship just nicks you on the side, you'll sustain minimal damage—but watch out if one hits you in the crosshairs at the center of the screen.

Shuttle Command provides several options before play starts. You can choose a one or two-player game. You select the keyboard or joystick version—or even different types of joystick action. You can also choose whether the enemy ships will approach slowly or quickly, and how accurate your shots must be.

In summary, *Shuttle Command* does have several nice features: some pleasing arcade effects, unusual rewards for shooting accuracy, and an instrument panel that really "works." I wonder, though, if the game couldn't offer a bit more variety. When compared with other space battle games, *Shuttle Command* seems somewhat repetitive. In *Star Raiders*, for example, you are trying to do much more than simply blast the enemy. In *Shuttle Command*, however, this is *all* you do. If this "track'em and blast'em" type of action happens to be your cup of tea, then you'll probably like the game.

Henhouse

Reviewed by Greg Roberts

99'er Staff

Program Type:	**Farmer vs. Poachers**
Language:	**Assembly**
Distributor:	**Funware, Inc. 405 N. Bowser, Bldg. A. Richardson, TX 75081**
Price:	**TI-99/4A plug-in cartridge $39.95**

In the lyrics of an old Louis Jordan song, the farmer goes out at night to his chicken coop, and upon opening the door he hears a chorus: "There ain't nobody here but us chickens..." Well, there is a lot more than chickens to Funware's latest plug-in cartridge creation, *Henhouse*.

Henhouse is certainly one of the more complex games for the TI-99/4A—with exceptional graphics. Displayed in impressive detail are flying crows, a farmer, poacher, and wolf—and they move in an intricate fashion; the wings, elbows and knee joints are more animated, certainly, than those of the stilted cartoon characters now being served up on most other game cartridges. Only the game's background design is somewhat lacking in imagination, with simple block graphics making for a rather angular egg factory.

The scene is a barnyard with a chicken house and modern egg-gathering system made up of a

Continued on p. 50

Carrot lovers!

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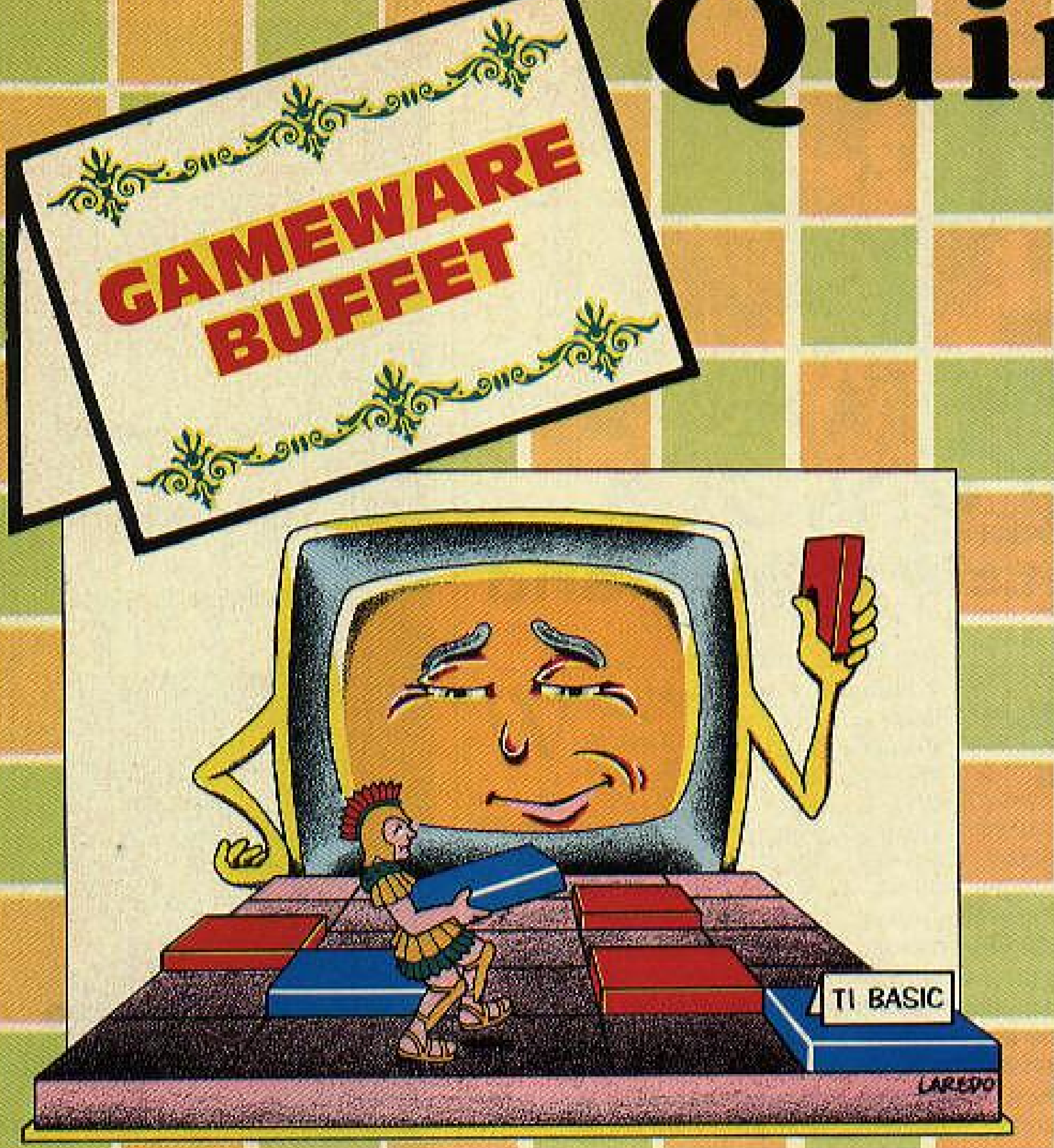
Quintus



By Sam Pincus
Contributing Editor

Quintus is a game of strategy with a simple design: a grid with 25 squares which you and the computer take turns claiming. There are only two rules: First, neither you nor the computer should take the middle square on the first move. Second, once a square has been claimed, the other player cannot claim a square either horizontally or vertically adjacent to it.

The computer keeps track of the available squares. If you have at least one move left, it lets you take your turn. If you do not have a move, it keeps claiming squares until *it* runs out of moves. Similarly, if the computer has no moves left, it lets *you* take multiple turns until you run out. When there are no moves left for either of you, the round is over.

The player who has claimed the most squares is the winner of the round. The winner's number of points is tallied as the *difference* between the two numbers of squares claimed. For example, if the winner claimed 10 squares and the loser claimed 8, the winner would receive two points. The game is over when either player reaches 7 points.

```
100 REM  ***********
110 REM  * QUINTUS *
120 REM  ***********
130 REM  BY SAM PINCUS
140 REM  99'ER VERSION 2.5.1
150 REM
160 RANDOMIZE
170 DIM GR(6,6)
180 GOSUB 1820
190 X=1
200 Y=1
210 J=2*Y+3
220 I=2*X+3
230 CALL GCHAR(I,J,CH)
240 Z=0
250 CALL HCHAR(I,J,100,2)
260 CALL HCHAR(I+1,J,100,2)
270 CALL KEY(1,R,S)
280 IF S THEN 360
290 IF Z THEN 240
300 Z=1
310 CALL HCHAR(I,J,CH)
320 CALL HCHAR(I+1,J,CH)
330 CALL HCHAR(I,J+1,CH)
340 CALL HCHAR(I+1,J+1,CH)
350 GOTO 270
360 IF CH<>96 THEN 420
370 CALL HCHAR(I,J,96)
380 CALL HCHAR(I+1,J,98)
390 CALL HCHAR(I,J+1,97)
400 CALL HCHAR(I+1,J+1,99)
410 GOTO 440
420 CALL HCHAR(I,J,CH,2)
430 CALL HCHAR(I+1,J,CH,2)
440 IF R=2 THEN 590
450 IF R=3 THEN 630
460 IF R=5 THEN 510
470 IF R+1=1 THEN 550
480 IF R=1 THEN 670
490 GOTO 240
500 REM  UP
510 IF X=1 THEN 290
520 X=X-1
530 GOTO 210
540 REM  DOWN
550 IF X=5 THEN 290
560 X=X+1
570 GOTO 210
580 REM  LEFT
590 IF Y=1 THEN 290
600 Y=Y-1
610 GOTO 210
620 REM  RIGHT
630 IF Y=5 THEN 290
640 Y=Y+1
650 GOTO 210
660 REM  HIT
670 IF GR(X,Y)=1 THEN 1370
680 IF GR(X,Y)=3 THEN 1370
690 TU=1
700 IF GR(X-1,Y)>1 THEN 720
710 GR(X-1,Y)=GR(X-1,Y)+2
720 IF GR(X+1,Y)>1 THEN 740
730 GR(X+1,Y)=GR(X+1,Y)+2
740 IF GR(X,Y-1)>1 THEN 760
750 GR(X,Y-1)=GR(X,Y-1)+2
760 IF GR(X,Y+1)>1 THEN 780
770 GR(X,Y+1)=GR(X,Y+1)+2
780 GR(X,Y)=3
790 HSC1=HSC1+1
800 CALL HCHAR(I,J,104,2)
810 CALL HCHAR(I+1,J,104,2)
820 IF SC=-100 THEN 1290
830 A=1
840 B=1
850 RO=21
860 CO=12
870 MS$="MY TURN"
880 GOSUB 2490
890 IF GR(3,3)>1 THEN 930
900 A=3
```

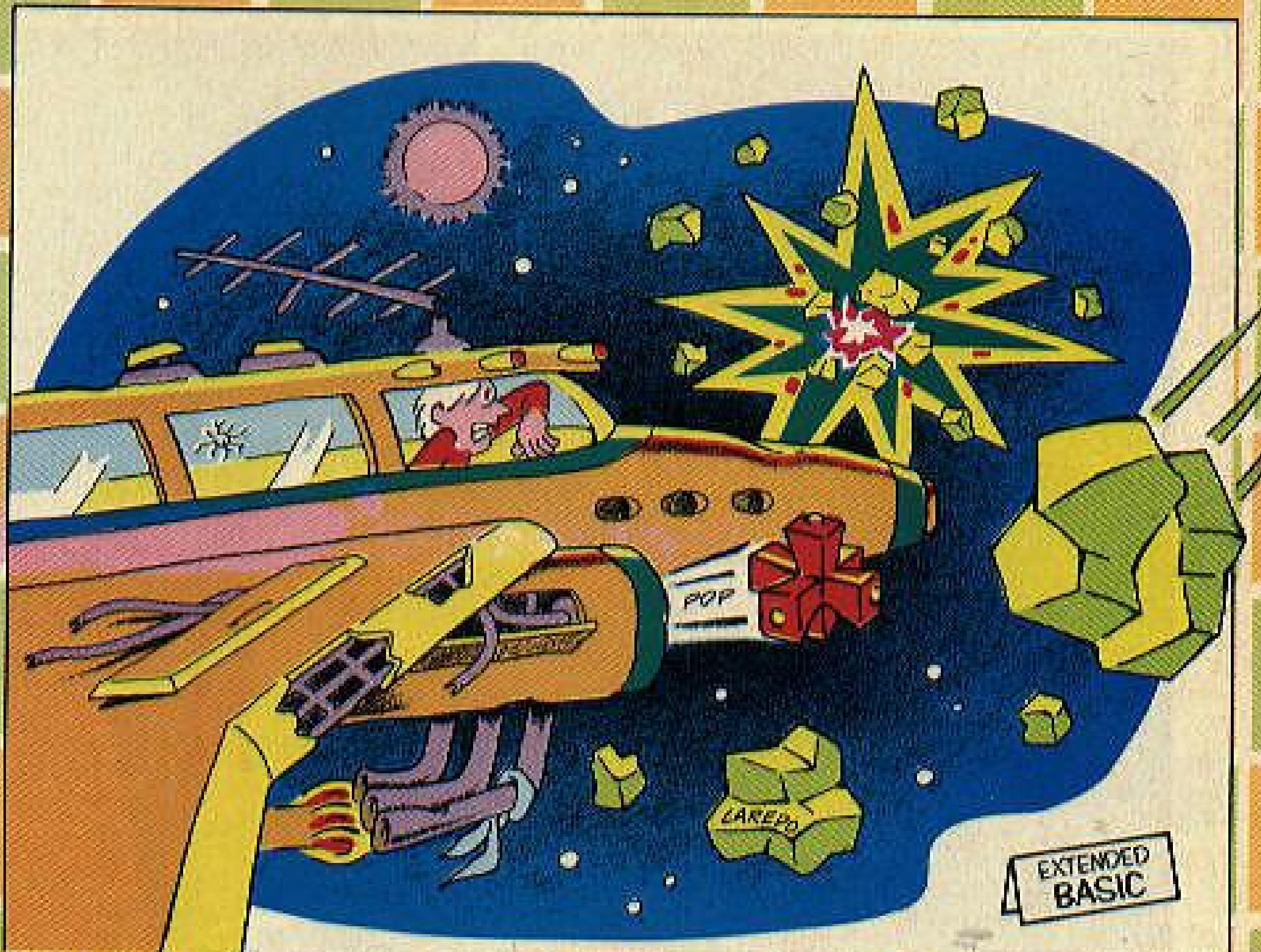
Continued on p. 46

EXPLANATION OF THE PROGRAM
Quintus

Line Nos.	
160-490	Flash the cursor and keep checking to see if a key was pressed. If so, it was edited with the control passing to the appropriate routine.
500-650	Move the cursor up, down, left and right.
660-860	Process the claim. First, a check is made to see if the square can be claimed. If not, control passes to an error routine. If the square can be claimed, it is colored and array GR is updated.
870-1380	Have the computer select its move based on the values found in the array GR. It figures the value of each move on the basis of both scoring its own points and ruining the scoring opportunities for its opponent.
1390-1760	Handle the end of a round and the end of the game.
1770-2130	Start the program off and give the original instructions.
2140-2430	Start off each round by drawing the grid and initializing the values inside GR.
2440-2480	Time delay.
2490-2520	Display MS$.

SPACE JUNKET

By Tarik Isani
601 Alleghany St.
Blacksburg, VA 24060



Cruising through space on the S. S. Methuselah, you have every reason to worry. A fine craft in her day, your ship is now, unfortunately, just one thrust from the scrap heap. Blazing meteoroids threaten from every direction, and it is all you can do to keep on course. As you are admiring the beautiful-but-deadly shower of meteoroids, one suddenly makes a bee-line for your battered nose cone. You try to activate your protective shields, only to find they are shorted to the catapult circuits of the mine launcher. The shields will only work while launching a mine, and then will not stay active for very long. Cursing the obsolete contraption, you fire on the approaching chunk of rock and ice. It is a direct hit, but. . .there is no explosion. Jumping Jupiter! These space mines are ancient—some of them are duds! Feverishly, you fire again, and smash the menacing meteoroid just inches from your craft. . .

An antiquated, unpredictable spacecraft adds an extra element of danger to *Space Junket*. The game is simple: A constant deluge of colorful meteoroids falls from the top and sides of the screen, and you must blast them before they hit your craft. Firing upon the meteoroids is your only defense; the ship's protective shield only stays up while you are shooting, and you can't move fast enough to dodge your meteor foes. When you have the time, you may want to maneuver your craft for a better aim, but remember your advanced age—three hits is all it takes before both of you are ready for recycling.

The Program

Space Junket is an *Asteroids* type game written in Extended BASIC. Several programming concessions had to be made in order to speed up the program. The most obvious of these is the functioning of the shields which work only during the flight of a mine. This was done so that coincidence checks would not have to be made with the spacecraft during the firing period, and the computer could concentrate on the mine coincidence checks. You can use either the keyboard or joysticks to control the spacecraft. To rotate in any one of eight directions, either press the S and D keys or move the joystick to the left or right. To activate your rocket engine you can either press E, or move the joystick forward. To launch a space mine in the direction you are pointing, you can press Q on the keyboard or the fire button on the joystick. When your spacecraft starts moving, it will continue to move in the same direction until you give it enough thrust in the opposite direction to stop. Once you have cleared the screen of meteoroids, you will be set against another wave of them. Now see how long you can survive.

EXPLANATION OF THE PROGRAM
Space Junket

Line Nos.	
170-220	Initialize variables, and set color assignments.
230-300	Display instructions.
310-320	Accept either keyboard, or joystick for input.
330-570	Define graphics characters.
580-660	Display playing screen, and wait for the fire button to start.
670-820	Main control loop.
830-840	Delete the mine when it gets out of range.
850-880	Meteoroid is hit and destroyed.
890-960	Your spacecraft is hit and destroyed.
970-1060	End the game when the last ship is destroyed.
1070-1100	When all of the meteroids are destroyed, start them all over

```
100 REM ****************
110 REM * SPACE JUNKET *
120 REM ****************
130 REM BY TARIK ISANI
140 REM 99'ER VERSION 2.5.1XB
150 REM
160 REM
170 CALL CLEAR :: CALL SCREEN(2)::
     RANDOMIZE
180 CALL MAGNIFY(3):: P,R=1 :: S=3
190 DIM M(8,2),DM(9)
200 DATA -20,0,-20,20,0,20,20,20,2
    0,0,20,-20,0,-20,-20,-20
210 FOR I=1 TO 8 :: FOR J=1 TO 2 :
    : READ M(I,J):: NEXT J :: NEXT
     I
220 FOR I=1 TO 12 :: CALL COLOR(I,
    14,2):: NEXT I
230 DISPLAY AT(1,5):"** SPACE JUNK
    ET **": :"               BY":"
          TARIK ISANI"
240 DISPLAY AT(6,1):"MANEUVER YOUR
       SPACECRAFT,":"CLEARING YOUR
    FLIGHT PATH OF"
250 DISPLAY AT(8,1):"METEOROIDS, W
    ITHOUT CRASHING":"INTO THEM."
260 DISPLAY AT(11,1):"ROTATE YOUR
    SHIP BY PRESSING'S' OR 'D', OR
     MOVE THE":"JOYSTICK LEFT AND
     RIGHT."
270 DISPLAY AT(15,1):"ACTIVATE YOU
    R ENGINES BY":"PRESSING 'E', O
    R MOVING THE JOYSTICK FORWARD.
    "
280 DISPLAY AT(19,1):"TO LAUNCH YO
    UR MINES PRESS  'Q', OR PRESS
    THE FIRE":"BUTTON ON THE JOYST
    ICK."
290 DISPLAY AT(24,1):"( PRESS ANY
    KEY TO START )"
300 CALL KEY(0,S1,S2):: IF S2=0 TH
    EN 300
310 DISPLAY AT(12,4)ERASE ALL:"MET
    HOD OF INPUT:": :"      1. JOY
    STICK": :"      2. ARROW KEYS"
320 CALL KEY(0,Z1,Z2):: IF Z1<49 O
    R Z1>50 THEN 320
330 CALL CLEAR
340 CALL COLOR(1,2,1,3,16,1,4,16,1
    ,5,2,16,6,2,16,7,2,14,8,9,1)
350 CALL CHAR(48,"007E42424242427E
    "):: CALL CHAR(49,"00080808080
    80808")
360 CALL CHAR(50,"007E02027E40407E
    "):: CALL CHAR(51,"007E02027E0
    2027E")
370 CALL CHAR(52,"004242427E020202
    "):: CALL CHAR(53,"007E40407E0
    2027E")
```

Continued on p. 45

If you're on a small budget...

Photo: Peter Rossi

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Space Junket . . . from p.43

```
380 CALL CHAR(54,"007E40407E42427E
    "):: CALL CHAR(55,"007E0202020
    20202")
390 CALL CHAR(56,"007E42427E42427E
    "):: CALL CHAR(57,"007E42427E0
    2027E")
400 CALL CHAR(74,"00FFFFFFFFFFFFFF
    FFFFFF")
410 CALL CHAR(80,"003C40405C444438
    003844447C44444400446C54544444
    44007C40407840407C")
420 CALL CHAR(84,"0000000000000000
    007C44444444447C00444444282810
    1000784444478504844")
430 GO$=CHR$(80)&CHR$(81)&CHR$(82)
    &CHR$(83)&CHR$(84)&CHR$(85)&CH
    R$(86)&CHR$(83)&CHR$(87)
440 CALL CHAR(88,"181818183C3C7E7E
    ")
450 CALL CHAR(92,"F8F8C0C0C0000303
    030300C0C0C0F8F81F1F030303000C0
    C0C0C0000303031F1F")
460 CALL CHAR(96,"0045104022000881
    002400411002200010004800842002
    008924400800288 4")
470 CALL CHAR(100,"804008220801140
    508012208422040800110045800008C
    010403080240080201")
480 CALL CHAR(104,"000003030303030
    70707071F1F1F1F000000C0C0C0C0C
    0E0E0E0E0F8F8F8F8")
490 CALL CHAR(108,"00000000103277
    FFF7F3F1F0F07030100081C3E7CF8F
    0E0F0E0C08080C08")
500 CALL CHAR(112,"00000038383F3F3
    F3F3F3F3838000000000000000080F
    CFCFCFC8")
510 CALL CHAR(116,"0103070F1F3F7FF
    F7F270301000000000080C08080C0E
    0F0E0F0F87C3E1C08")
520 CALL CHAR(120,"00001F1F1F07070
    707030303030300000000F8F8F8E0E
    0E0E0C0C0C0C0C")
530 CALL CHAR(124,"000103010103070
    F070F1F3E7C3810000800C0E0F0F8FCF
    EFFFEE4C08")
540 CALL CHAR(128,"000000000013F3
    F3F3F010000000000000001C1CFCF
    CFCFCFCFC1C1C")
550 CALL CHAR(132,"0010387C3E1F0F0
    70F070301010301000000000080C0E
    4FEFFFEFCF8F0E0C08")
560 CALL CHAR(136,"061D2E3D6E75A6F
    CCDAF793B3D161F07A0D85CF476AB5
    FCA6B2D2AF62E4AB08")
570 CALL CHAR(140,"0000000002040A0
    1010A040200000000000000040205
    08080502040")
580 CALL SOUND(100,900,0):: CALL S
    OUND(100,700,0):: CALL SOUND(1
    00,800,0):: CALL SOUND(100,100
    0,0)
590 CALL HCHAR(1,3,48,6):: DISPLAY
     AT(1,10):"HIGH:"&RPT$("0",6-L
    EN(STR$(HS)))&STR$(HS):: CALL
    HCHAR(2,12,74,4)
600 CALL HCHAR(1,25,88,S-1)
610 FOR I=2 TO 9 :: CALL SPRITE(#I
    ,136,INT(RND*14+3),1,INT(RND*2
    56+1),INT(RND*10+1),INT(RND*3+
    1)):: NEXT I
620 FOR I=2 TO 9 :: DM(I)=0 :: NEX
    T I
630 DISPLAY AT(1,23):RPT$(CHR$(88)
    ,S-1):: CALL SPRITE(#1,104,7,9
    5,125,0,0):: CALL SOUND(-50,90
    0,0):: X,Y=0
640 CALL PATTERN(#1,92)
650 CALL COLOR(#1,9):: CALL KEY(1,
    S1,S2):: CALL COLOR(#1,5)
660 IF S1<>18 THEN 650 ELSE CALL S
    PRITE(#1,104,11,95,125,0,0)
670 CALL COLOR(#1,11)
680 IF Z1=49 THEN CALL JOYST(1,A,B
    ):: GOTO 710
690 CALL KEY(1,S1,S2)
700 IF S1=2 THEN A=-4 :: B=0 ELSE
    IF S1=3 THEN A=4 :: B=0 ELSE I
    F S1=5 THEN A=0 :: B=4 ELSE A,
    B=0
710 IF X<>0 OR Y<>0 THEN V=30-MAX(
    ABS(X),ABS(Y)):: CALL SOUND(-1
    000,-6,V,110,V,110,V)
720 IF A<>0 OR B<>4 THEN 750 ELSE
    X1=X+M(P,1)/10 :: X=MIN(ABS(X1
    ),20)*SGN(X1)
730 Y1=Y+M(P,2)/10 :: Y=MIN(ABS(Y1
    ),20)*SGN(Y1)
740 CALL MOTION(#1,X,Y):: GOTO 760
750 P=P+SGN(A):: IF P=0 THEN P=8 E
    LSE IF P=9 THEN P=1
760 CALL PATTERN(#1,(4*P)+100):: F
    OR J=2 TO 9 :: IF DM(J)=1 THEN
     770 :: CALL COINC(#J,#1,16,H)
    :: IF H THEN 900
770 NEXT J :: CALL KEY(1,C,D):: IF
     C<>18 THEN 680
780 CALL POSITION(#1,PO1,PO2)
790 CALL SPRITE(#10,140,16,PO1,PO2
    ,M(P,1),M(P,2)):: CALL COLOR(#
    1,8):: CALL PATTERN(#1,92)
800 CALL SOUND(-500,110,5,440,0)
810 FOR J=2 TO 9 :: IF DM(J)=1 THE
    N 820 :: CALL COINC(#J,#10,16,
    H):: IF H THEN 860
820 NEXT J :: VP=VP+1 :: IF VP=3 T
    HEN 840 ELSE 810
830 REM DELETE MISSILE
840 CALL DELSPRITE(#10):: VP=0 ::
    GOTO 670
850 REM ASTEROID HIT
860 CALL DELSPRITE(#10)
870 CALL PATTERN(#J,96):: CALL SOU
    ND(-500,-7,0):: CALL DELSPRITE
    (#J):: DM(J)=1 :: SC=SC+40+R*5
880 VP=0 :: DISPLAY AT(1,1)SIZE(6)
    :RPT$("0",6-LEN(STR$(SC)))&STR
    $(SC):: HI=HI+1 :: IF HI=8 THE
    N 1080 ELSE 670
890 REM CRASH
900 CALL COLOR(#1,9):: CALL PATTER
    N(#1,100,#J,96):: DM(J)=1
910 CALL SCREEN(12)
920 CALL SCREEN(2):: FOR I=0 TO 30
     STEP 2 :: CALL SOUND(-500,-6,
    I):: CALL SOUND(-500,-5,I):: N
    EXT I
930 FOR I=1 TO 3 :: CALL SCREEN(12
    ):: CALL SCREEN(2):: NEXT I ::
     S=S-1
940 FOR I=1 TO 100 :: NEXT I :: CA
    LL DELSPRITE(#J,#10):: FOR I=1
     TO 100 :: NEXT I
950 HI=HI+1 :: IF HI=8 THEN 1080
960 IF S<>0 THEN P=1 :: GOTO 630
970 CALL DELSPRITE(#1):: FOR I=30
    TO 0 STEP -1 :: CALL SOUND(-20
    0,-5,I):: NEXT I
980 FOR I=1 TO 3 :: CALL SCREEN(12
    ):: CALL SOUND(-200,-5,0):: CA
    LL SCREEN(2):: CALL SOUND(-200
    ,-6,0):: NEXT I
990 CALL SOUND(-400,-7,0)
1000 IF SC<=HS THEN 1040 ELSE HS=SC
1010 FOR I=1 TO 200 :: NEXT I :: DI
     SPLAY AT(1,15)SIZE(6):RPT$("0"
     ,6-LEN(STR$(HS)))&STR$(HS)
1020 FOR I=1 TO 10 :: CALL COLOR(5,
     2,7,6,2,7):: CALL SOUND(-200,9
     00,0)
1030 CALL COLOR(5,2,16,6,2,16):: CA
     LL SOUND(-200,800,0):: NEXT I
1040 X,Y,SC,HI=0 :: R,P=1 :: S=3 ::
      DISPLAY AT(12,10):GO$
1050 CALL COLOR(7,14,2):: CALL KEY(
     1,A,B):: CALL COLOR(7,2,14)::
     IF B=0 THEN 1050 ELSE CALL HCH
     AR(12,1,32,32)
1060 GOTO 580
1070 REM ALL DESTROYED
1080 CALL DELSPRITE(ALL)
1090 CALL SOUND(200,9999,30):: CALL
      SOUND(20,1100,0):: CALL SOUND
     (60,9999,30):: CALL SOUND(300,
     1100,0)
1100 P=1 :: R=MIN(R+1,4):: HI=0 ::
     IF S=0 THEN 970 ELSE 610
```

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Quintus ...from p.42

```
910 B=3
920 GOTO 1150
930 SC=-100
940 FOR C=1 TO 5
950 FOR D=1 TO 5
960 IF GR(C,D)>1 THEN 1120
970 TSC=0
980 XY=GR(C-1,D)
990 TSC=TSC-1.5*(XY=0)-2*(XY=2)+2*
    (XY=3)
1000 XY=GR(C+1,D)
1010 TSC=TSC-1.5*(XY=0)-2*(XY=2)+2*
    (XY=3)
1020 XY=GR(C,D-1)
1030 TSC=TSC-1.5*(XY=0)-2*(XY=2)+2*
    (XY=3)
1040 XY=GR(C,D+1)
1050 TSC=TSC-1.5*(XY=0)-2*(XY=2)+2*
    (XY=3)
1060 IF TSC<SC THEN 1120
1070 IF TSC>SC THEN 1090
1080 IF RND>=.5 THEN 1120
1090 SC=TSC
1100 A=C
1110 B=D
1120 NEXT D
1130 NEXT C
1140 IF SC=-100 THEN 1270
1150 GR(A,B)=3
1160 IF (GR(A-1,B)=0)+(GR(A-1,B)=2)
     THEN 1170 ELSE 1180
1170 GR(A-1,B)=GR(A-1,B)+1
1180 IF (GR(A+1,B)=0)+(GR(A+1,B)=2)
     THEN 1190 ELSE 1200
1190 GR(A+1,B)=GR(A+1,B)+1
1200 IF (GR(A,B-1)=0)+(GR(A,B-1)=2)
     THEN 1210 ELSE 1220
1210 GR(A,B-1)=GR(A,B-1)+1
1220 IF (GR(A,B+1)=0)+(GR(A,B+1)=2)
     THEN 1230 ELSE 1240
1230 GR(A,B+1)=GR(A,B+1)+1
1240 TISC1=TISC1+1
1250 CALL HCHAR(2*A+3,2*B+3,112,2)
1260 CALL HCHAR(2*A+4,2*B+3,112,2)
1270 MS$="                    "
1280 GOSUB 2490
1290 FOR A=1 TO 5
1300 FOR B=1 TO 5
1310 IF GR(A,B)>2 THEN 1340
1320 IF GR(A,B)=1 THEN 1340
1330 GOTO 190
1340 NEXT B
1350 NEXT A
1360 IF SC=-100 THEN 1400 ELSE 820
1370 CALL SOUND(300,440,0,660,0,880
     ,0)
1380 GOTO 240
1390 REM  END OF GAME
1400 TSC=HSC1-TISC1
1410 IF TSC>0 THEN 1480
1420 IF TSC<0 THEN 1450
1430 MS$=" A TIE GAME"
1440 GOTO 1500
1450 TISC=TISC+ABS(TSC)
1460 MS$="I WON!!"
1470 GOTO 1500
1480 HSC=HSC+TSC
1490 MS$="YOU WON"
1500 RO=21
1510 CL=7
1520 GOSUB 2490
1530 GOSUB 2440
1540 IF TISC>=7 THEN 1580
1550 IF HSC>=7 THEN 1580
1560 GOSUB 2090
1570 GOTO 190
1580 RO=21
1590 CO=7
1600 MS$="GAME'S OVER  "
1610 GOSUB 2490
1620 RO=22
1630 IF HSC>=7 THEN 1670
1640 CO=9
1650 MS$="I WON!"
1660 GOTO 1690
1670 MS$="YOU WON!"
1680 CO=8
1690 GOSUB 2490
1700 GOSUB 2440
1710 GOSUB 2440
1720 CALL CLEAR
1730 INPUT "WANT TO PLAY AGAIN?(Y/N
     ) ":MS$
1740 MS$=SEG$(MS$,1,1)
1750 IF MS$="Y" THEN 1770
1760 STOP
1770 GOSUB 2070
1780 GOTO 190
1790 REM
1800 REM
1810 REM  START OF PGM
1820 CALL CLEAR
1830 PRINT "           QUINTUS!"::::::
     "        BY SAM PINCUS"::::::::
1840 CALL CHAR(96,"FF80808080808080
     ")
1850 CALL CHAR(97,"FF01010101010101
     ")
1860 CALL CHAR(98,"80808080808080FF
     ")
1870 CALL CHAR(99,"01010101010101FF
     ")
1880 CALL CHAR(100,"FFFFFFFFFFFFFFF
     F")
1890 CALL CHAR(104,"FFFFFFFFFFFFFFF
     F")
1900 CALL CHAR(112,"FFFFFFFFFFFFFFF
     F")
1910 CALL COLOR(10,5,2)
1920 CALL COLOR(11,7,2)
1930 INPUT "NEED INSTRUCTIONS?(Y/N)
      ":MS$
```

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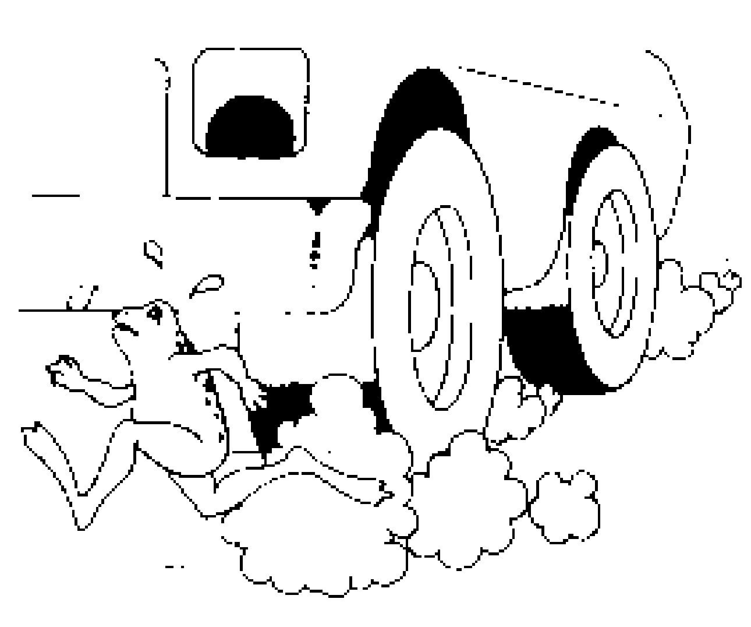
Quintus

```
1940 MS$=SEG$(MS$,1,1)
1950 IF MS$="Y" THEN 1960 ELSE 2070
1960 PRINT "THERE ARE 25 SQUARES ON
      A   GRID. WE BOTH TAKES TURNS
        FILLING THE SQUARES."
1970 PRINT "THERE ARE ONLY 2 RULES:
     ":"1-YOU CANNOT TAKE THE MIDDL
     ESQUARE ON THE FIRST MOVE."
1980 PRINT "2-YOU CANNOT TAKE A SQU
     ARE"
1990 PRINT "HORIZONTALLY OR VERTICA
     LLY  NEXT TO A SQUARE THAT I O
     WN.":"MY SQUARES ARE RED, YOUR
     "
2000 PRINT "SQUARES ARE BLUE. THE C
     URSOR"
2010 PRINT "IS BLACK. USE THE 4 ARR
     OW   KEYS TO MOVE THE CURSOR.
        PRESS 'A' TO CLAIM A SQUARE
     ."
2020 PRINT "A ROUND IS OVER WHEN AL
     L OF THE POSSIBLE SQUARES ARE"
2030 PRINT "TAKEN. WHEN A ROUND END
     S,   THE WINNER RECEIVES POINT
     S  EQUAL TO THE AMOUNT OF"
2040 PRINT "SQUARES HE WON BY. THE
     GAME IS OVER WHEN SOMEONE GETS
      7 POINTS."
2050 PRINT "PRESS ANY KEY TO START"
2060 GOSUB 2440
2070 TISC=0
2080 HSC=0
2090 CALL SCREEN(2)
2100 CALL CLEAR
2110 CALL COLOR(9,2,2)
2120 PRINT TAB(20);"HUMAN"::TAB(21)
     ;HSC:::TAB(19);"TI-99/4A"::TA
     B(21);TISC
2130 PRINT ::::::::::::
2140 FOR X=5 TO 14 STEP 2
2150 CALL HCHAR(X,5,96,10)
2160 CALL HCHAR(X+1,5,98,10)
2170 CALL HCHAR(X,6,97)
2180 CALL HCHAR(X,8,97)
2190 CALL HCHAR(X,10,97)
2200 CALL HCHAR(X,12,97)
2210 CALL HCHAR(X,14,97)
2220 CALL HCHAR(X+1,14,99)
2230 CALL HCHAR(X+1,12,99)
2240 CALL HCHAR(X+1,10,99)
2250 CALL HCHAR(X+1,8,99)
2260 CALL HCHAR(X+1,6,99)
2270 NEXT X
2280 CALL SCREEN(12)
2290 CALL COLOR(9,2,8)
2300 HSC1=0
2310 TISC1=0
2320 TU=0
2330 SC=0
2340 FOR X=1 TO 5
2350 GR(X,0)=88
2360 GR(X,6)=88
2370 GR(0,X)=88
2380 GR(6,X)=88
2390 FOR Y=1 TO 5
2400 GR(X,Y)=0
2410 NEXT Y
2420 NEXT X
2430 RETURN
2440 FOR X=1 TO 1000
2450 CALL KEY(0,KEY,STAT)
2460 IF STAT<>0 THEN 2480
2470 NEXT X
2480 RETURN
2490 FOR X=1 TO LEN(MS$)
2500 CALL HCHAR(RO,CO+X-1,ASC(SEG$(
     MS$,X,1)))
2510 NEXT X
2520 RETURN
```



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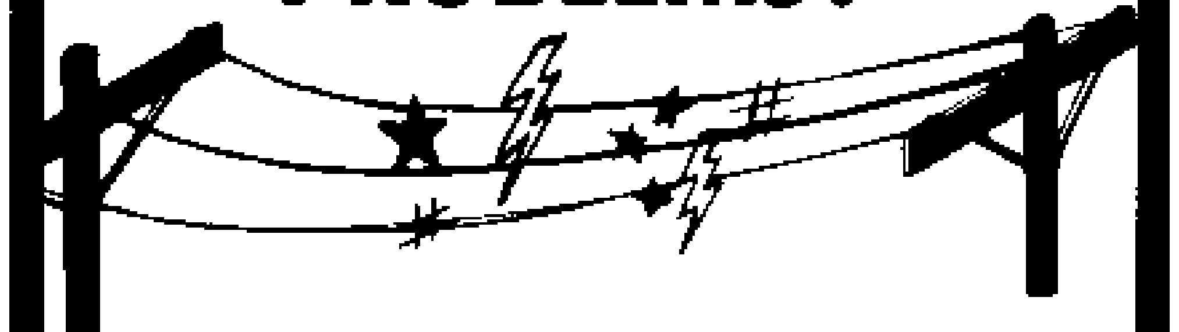

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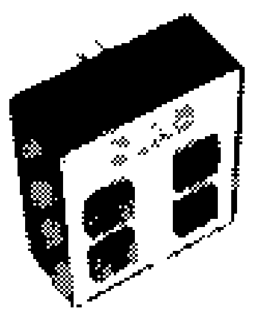

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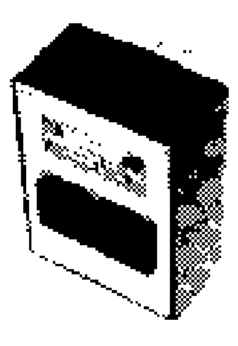

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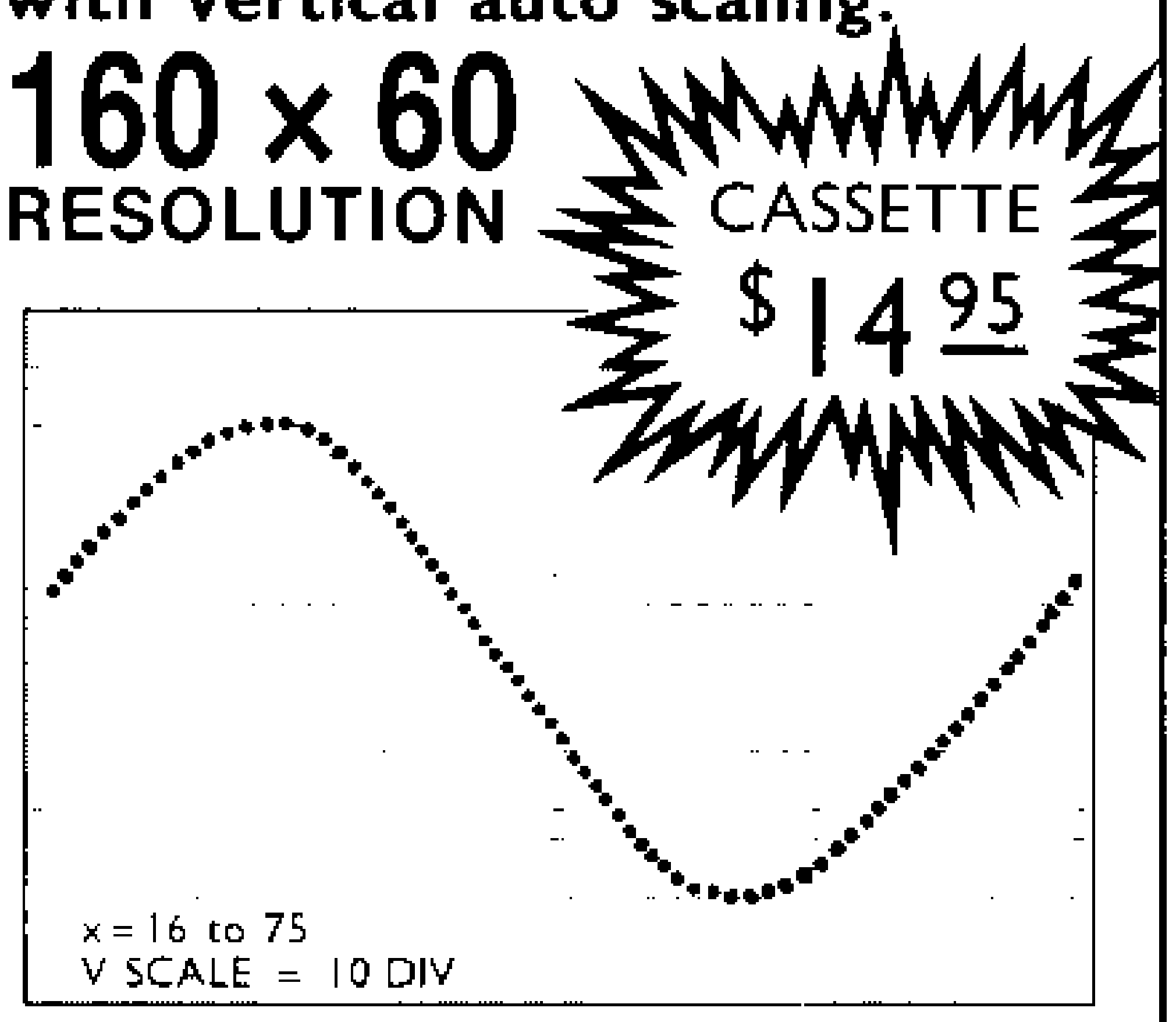

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Letters on LOGO . . . from p.37

```
MAKE "PROCNAME WORD "P
  CHAR :N
DEFINE :PROCNAME [ [ ] ]
FILLPROC :N + 1
END
```

Data levels reported by Williams from running his versions of FILLPROC follow:

Apple LOGO. . .	236
Terripin/Krell LOGO. . .	271
TI LOGO. . .	29

Our result:
TI LOGO reached level 119.

Our version of FILLPROC ran through 119 levels on the TI before "CHOKING." It probably ran through so many more levels because it avoided the extra levels of recursion introduced by Williams' PICK procedure.

(4) Williams indicates that one problem with the TI LOGO editor is its inability "to exit the editor while leaving the procedure as it was before editing started." A simple way to do this is to delete or change the procedure name before leaving the editor. Under these circumstances the procedure with the original procedure name will be left "as it was before editing started."

We have both TI-99/4 and TI-99/4A systems. With our class we have used the TI-99/4. The keyboard is a simpler one for the youngsters to start with.

If we were to purchase another system with LOGO today for a similar class we would certainly select the TI again. It is less than half the cost of the other available systems and has been performing reliably and well. It has provided a most stimulating computing environment for our youngsters. We are glad to hear that TI will be releasing a second version of LOGO soon and hope to obtain a copy when it becomes available.

Elizabeth Cuthill & Elizabeth Fletcher
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Joystick Jockey . . . from p.39

stick is also an important consideration. You may find a small joystick difficult to grip, but you can manipulate it using only your hand muscles. A large, easy-to-grasp joystick, on the other hand, may require the movement of your entire arm. These differences can be crucial—hand and arm fatigue among joystick jockeys is an "occupational hazard."

A hand-held model in a class by itself is Milton Bradley's analog joystick. An analog joystick can provide a much finer degree of control, allowing more precise movement on screen. Keep in mind, however, that you must have software especially written to take advantage of these capabilities. The Milton Bradley model is shaped like a ray-gun with a pistol grip, a rotating knob that either spins objects or changes their velocities, and three control buttons (in addition to the trigger-like firing button). It does, however, require the Milton Bradley Expander™ (to be available in the late third quarter of 1983) which plugs into the joystick port.

Table It

The table-top models are larger and less common than the hand-helds. For example, the Command Control™ joystick by Wico Corp. may be the right choice for those who prefer the heft and stability of a table-top stick. This type of stick leaves you one hand free to simultaneously work the keyboard (or just munch popcorn). When playing *Parsec*, for example, you can change your lift levels without taking your hand off the joystick.

A new variant in the table-top collection has recently appeared on the market. The "track-ball" type of controller consists of a plastic sphere that is inset into a base. To move it, you run your palm or finger tips over the ball, rotating it in the desired direction. For those of you who tend to grip the stick tightly—digging you fingernails into your palms when things get tense—this model could be just the thing. We have yet to find one of these,

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however, that works well with current programming on the TI-99/4A, so once again, we caution you to try before buying.

Button Your Blip

No joystick would be complete without the "fire button." That's the little button which spells death to thousands of aliens and all kinds of little munchers. The placement of the fire button on the joystick could mean the difference between just giving those aliens a run for their money, or really knocking the socks off 'em.

There are basically three places on the joystick where the fire button can be: The most common is the base-thumb position. This button is placed so that it can be pressed by the thumb of the hand holding onto the base of the joystick. If you're a lefty, you may want to pay attention to which side of the joystick the button is on. The best solution is a joystick which can be used by left- or right-handed people, such as TI's joystick. The button is wide enough so that either side could be used.

The next fire button position is in the tip of the stick. Wico's switch-selectable Command Control has one button at the tip and another at the base-thumb position. This location gives one of your hands all the movement control and firepower, while the other hand simply has to worry about holding on for dear life.

The last place you might find the button is the base-index position. Milton Bradley's analog joystick has its fire button in this position in the form of a pistol grip, plus an additional three buttons in the base-thumb position. This pistol grip allows the player to fire with the index finger of the hand holding the base.

Software-Dependent Joy

There seems to be some common problems with all the joystick devices we have tried. But in all fairness, some of these inconsistencies may not be the fault of the joystick itself, but rather of the game design. The responsiveness of the joystick is dependent upon how it is interrogated by the game's software. The design of high-quality game software must therefore take into account the *human engineering* aspects of the joystick interface. And some games currently available have better joystick interaction than others.

When you are selecting your joystick device, we recommend using the same game to test each model. This way you can observe true performance differences regardless of discrepancies between various games' software.

The joystick has indeed come a long way since its lowly beginnings in the cockpit. And chances are that it will develop even further until today's simple stick-and-firing-button model will seem as primitive to us as the room-sized ENIAC Computer. Fortunately, the joystick's price is low enough so that you can update your system when important developments show up on the shelves.

Command Control is a trademark of Wico Corp.

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A Reader Asks:

I ran into some strange TI BASIC instructions while I was putting a program into my TI-99/4A. The program was the "Character Definition" program that is on page III-26 of the TI-99/4A User's Reference Guide. With some study, I could understand most of the program. But I was baffled by line 390 and line 430. The text to the left side of the page says "Line 430 performs a logical OR." The text says nothing about line 390. Can you tell me what is going on here?

99'er HCM Answers:

O.K. first let me suggest that you read the TI-99/4A User's Reference Guide pages II-51 and II-52 that describe in general the IF-THEN-ELSE. Now let's talk about the two lines you have been wondering about:

```
390 IF (KEY< >8)+(KEY< >9)= -2 THEN 420
430 IF (KEY<0)+(KEY>1) = -1 THEN 370
```

These statements are called "logical IF" type statements. An English translation of line 390 would be:

390 IF KEY is not equal to 8 and KEY is not equal to 9 THEN 420

An English translation of line 430:

430 IF KEY is less than 0 or KEY is greater than 1 THEN 370

The computer evaluates the relationship expressed between the word IF and the word THEN to see if is is true or false. Sometimes the relationship expressed is complex as in these cases. In such cases, the computer must evaluate the "sub-relationships" (ie: (KEY< >8) or (KEY< > 1)) to see if they are true or false first. If the "sub-relationship" is evaluated as true, it is assigned the number "-1." If it is false a value of "0" is assigned to it. Using these assigned values, the main relationship is evaluated by the computer. If it is true, the program is directed to the line number following the word "THEN." If it is false, the program is directed to the next program line.

Let's try to clarify this by pretending we are the computer as it is executing line 390. The steps we must follow are:

1. Evaluate to true (-1) or false (0) the sub-relationship (KEY< >8).
2. Evaluate to true (-1) or false (0) the sub-relationship (KEY< >9).
3. Evaluate to true or false the total relationship using the results of steps 1 and 2: (-1 or 0) + (-1 or 0) = -2.
4. If step 3 evaluates to true "THEN" go to line 420. If step 3 evaluates to false "fall through" to the next line 400.

Note that in step 3 above both "sub-relationships" must be true or —1 to cause the total relationship to be true. In other words, (KEY< >8) "AND" (KEY< >9) must be true. Now let's play computer with line 430 and assume that the variable KEY has a value of "0":

1. (KEY<0) evaluates to false or 0.
2. (KEY>1) evaluates to false or 0.
3. 0 + 0 = -1 evaluates to false.
4. The computer will "fall through" and execute line 440 next.

Now you try "playing computer" substituting various values for KEY in the two logical IF statements. This practice will help reveal to you what is going on. By the way, TI Extended BASIC allows writing logical IF statements in a more understandable fashion. For instance:

```
390 IF (KEY< >8) AND (KEY< >9) THEN 420
430 IF (KEY<0) OR (KEY>1) THEN 370
```

Henhouse from p.41

series of chutes and bins. When a bin gets full, you have to direct the farmer to gather up the eggs and put them on a truck, or they will start to break; six lost eggs means the game is over. Another threat is a poacher who randomly raids the henhouse; unless he's laid low by the farmer's shotgun (fired by your joystick button or Q key), the poacher will make off with an egg, bringing you closer to your six-egg limit.

If that weren't enough, a wolf can come out of nowhere; when you see him coming, you'd better shoot before he makes it to the henhouse, or he'll knock your game for a loop. Meanwhile, the farmer can score in many ways: by putting eggs on the truck, shooting wolves and poachers, or annihilating an endless line of birds flying across the top of the screen. When the shooting builds up to a score of 5000, you get an extra egg.

The farmer's "shootin' iron" is not the best. As a man who is probably more interested in haybalers and manure spreaders than in the fine points of shooting, it appears he has ended up with one of those cheaper mail-order shotguns which can sometimes be unresponsive. I was missing some birds when I felt I was right on target—eyeballs riveted on the crows, my thumbnail white on the joystick button—and yet this apparent delay in the firing is not as severe as in other games I've played. In fact, many players will not see it as a problem at all.

The complex scenario of the game should wear long and well with most players—who will undoubtedly feel challenged to come up with involved strategies. And yet, in spite of the game's technical achievements, I personally find its content disturbing. For example, I'm a little put off by having to shoot someone for stealing an egg. And when the poacher goes down, he doesn't just blip from the screen like Munchman's lunch: he lies there for awhile crumpled up like Lee Van Cleef in *Gunfight at the OK Corral*. Neither does it seem OK to watch the wolf go through his death throes; after all, we're talking about an endangered species here. Not that I'm against hunting . . . but the thought of shooting people and wolves (even in a computer game) makes a thoughtful person about as comfortable as a goldfish on shag carpet.

"But it's only a game," you might say, "and a really well-engineered one at that."

Yes, but Funware might have refined the game by having the farmer blast the poacher and wolf with rock salt—which would have led to some entertaining graphics and taken nothing from the excitement of the play.

In my personal opinion, it is no longer enough for game designers to be technical wizards at programming. As this industry starts to grow up, the buyer will demand games that are not only beautifully programmed, but which carry responsible scenarios too.

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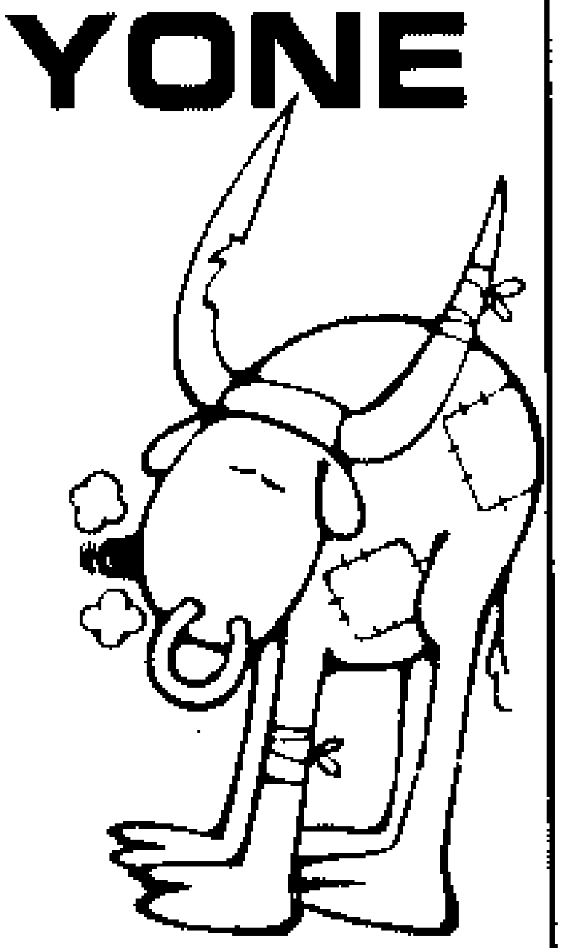

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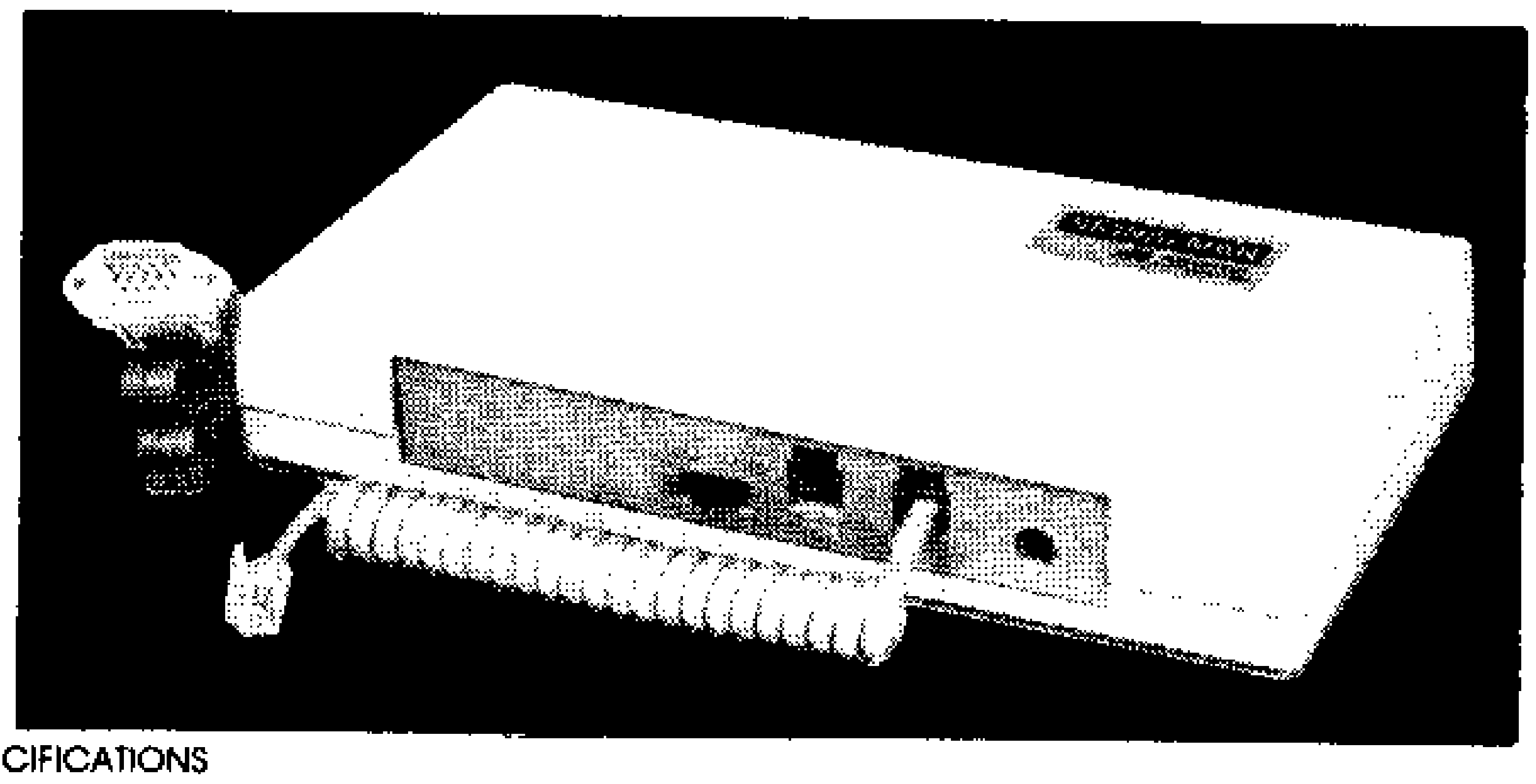

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Operate Mode	Manual dial, Automatic ANSW/ORIG selection		
Data Rate	0 to 300 bps, full duplex		
Modulation	Frequency shift-keyed (FSK)		
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Transmit Level	−12 dBm typical		
Receive Frequency		ORIG	ANSW
	MARK	2225 Hz	1270 Hz
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Receive Frequency Tolerance	±0.5%		
Carrier Detect Threshold	−44 dBm typical		
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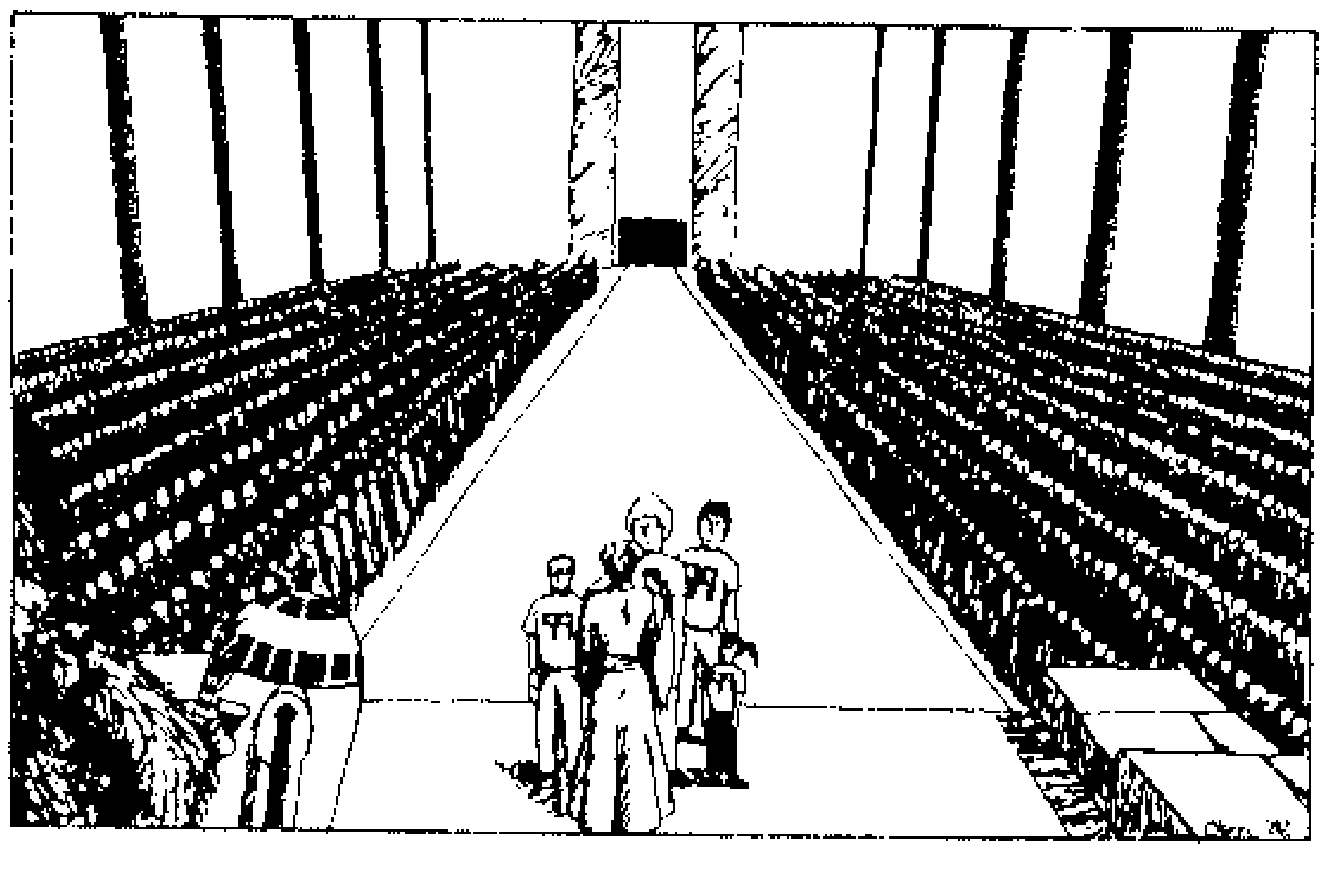

Correction: The name of the Parsec inductee in January's *Hall of Fame* should have been listed as John Douglas Gardner.

Name: Ed McNair (of Brandon, FL)
Game: Car Wars
Score: 97,380

Name: Chris Zimmerman (of Corning, NY)
Game: Munchman
Score: 185,160 (38th board)

Name: Kathy S. Cornwell (of Rancho Cordova, CA)
Game: Tombstone City
Score: 89,150

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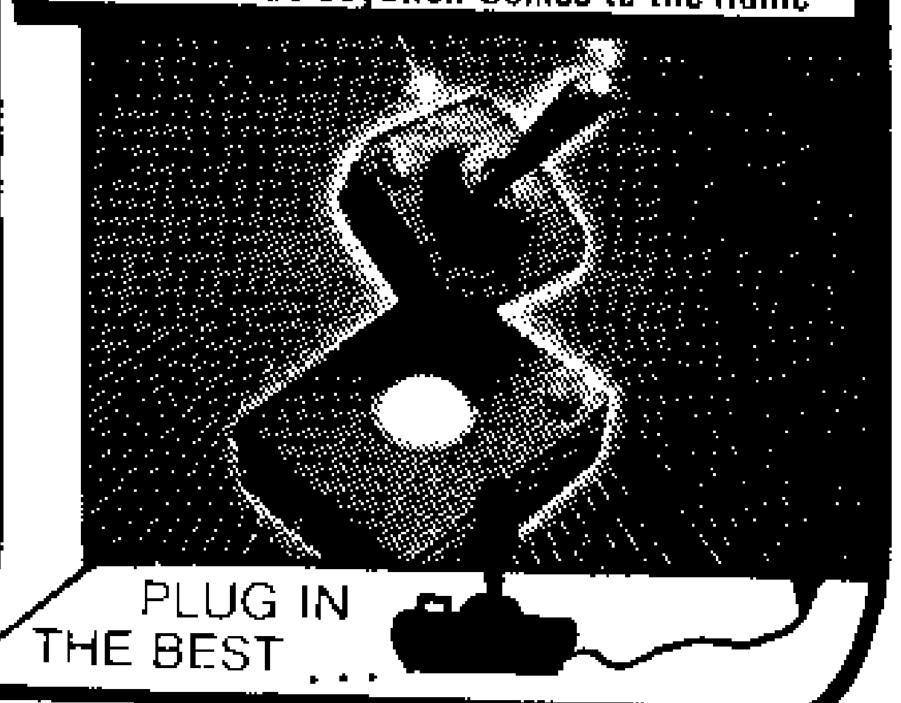

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ROBOTS . . . from p.33

and in some cases do it better. Well, chances are you will never see *that* robot in your lifetime. The universal or all-purpose robot just does not make sense from an economical or functional viewpoint. It would be redundant to build a robot with the same mechanical functioning as the human body.

Bill Bakaleinikoff has built several robots from mannequins, and these have received negative responses because people were intimidated by the robot's human form. For this reason, the personal robot will probably be made to look cute, perhaps even cuddly. This robot will become like a pet, and serve the household as a combination housekeeper and security system. A second type will be more functional in design, and may not even look like a robot at all. It will be more in the form of an automated device such as a food processing center, or environmental manager. There will probably be a maintenance computer that will turn on the lawn sprinkler, wash the windows, clean the floors, and de-ice the driveway when it freezes.

The personal robot will be mobile, and come as a base unit with connectors for manipulators or arm attachments. Each arm will be designed for particular tasks.

One might ask, "How will the robot function in a world built for the human body?" The answer to that will be to *alter* the world we live in. We have adjusted our environment in many ways for a newer technology. We will do the same for robotics. Instead of building a robot that can climb stairs, we will build ramps to replace the stairs. (This will not only make robotics simpler, it will make a lot of handicapped people happier also.)

The kitchen will probably undergo the most change. There will be no stove, refrigerator or cupboard. All of the dishes, cups, and silverware will be kept in hidden bins so that they are accessible to the robot. I can't imagine a robot that could get upon a chair to reach items on the top shelf; everything will have to be kept within its reach. The food processing center will replace the refrigerator, freezer, stove, and oven. Food may be stored in freeze-dried packets in a pre-selection compartment. The computer will then calculate a well-balanced meal, place the food into a microwave oven, cook it, and present it through a slot in the wall for the personal robot to pick up and serve at the table. When the food supplies run low, the computer will re-order them and have the bill automatically deducted at your bank. Once the meal is over, your personal robot will pick up the dishes and feed them into the sonic dishwasher. From there they go back to their storage bins.

Sounds far-fetched? Well it's really not. It's not even science fiction anymore, because we have the technology to do all the things I just mentioned. Within twenty or thirty years almost every home will fit that description.

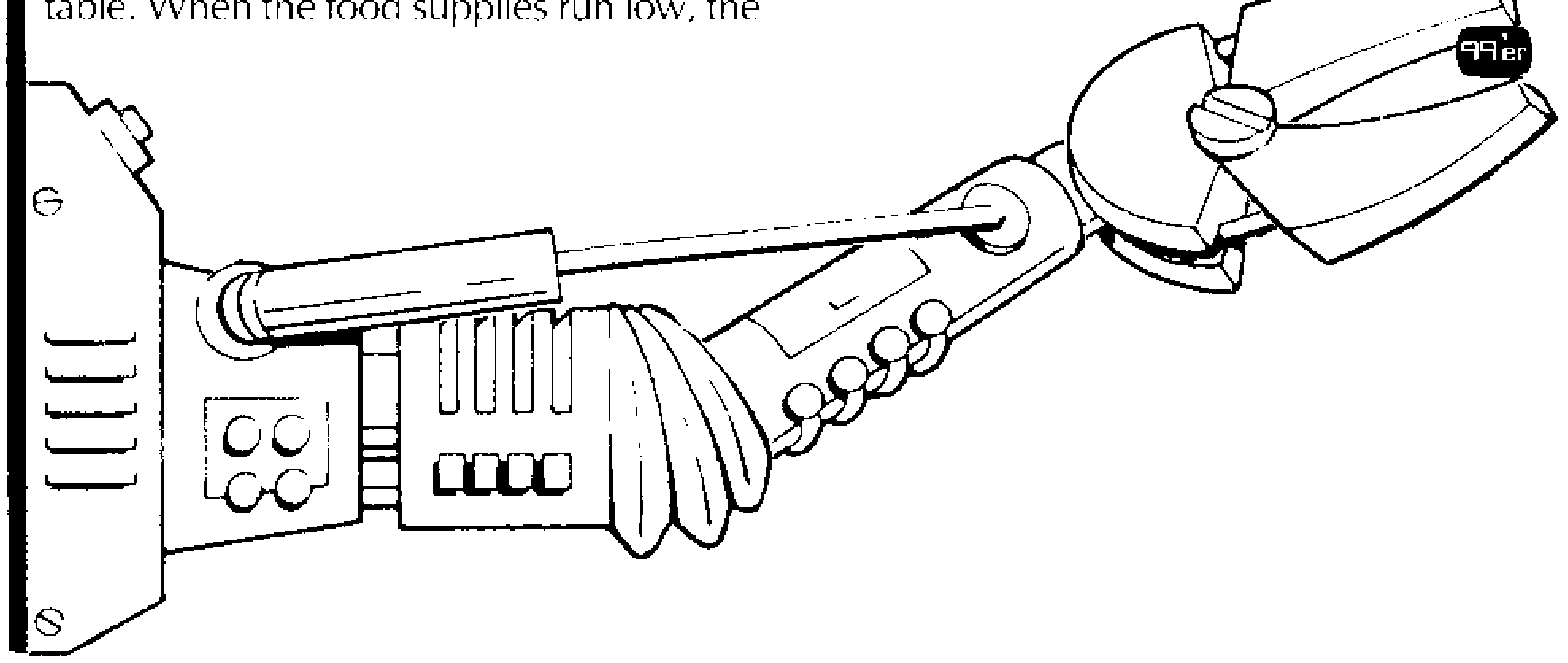
Robot Cavalry Comes to the Rescue

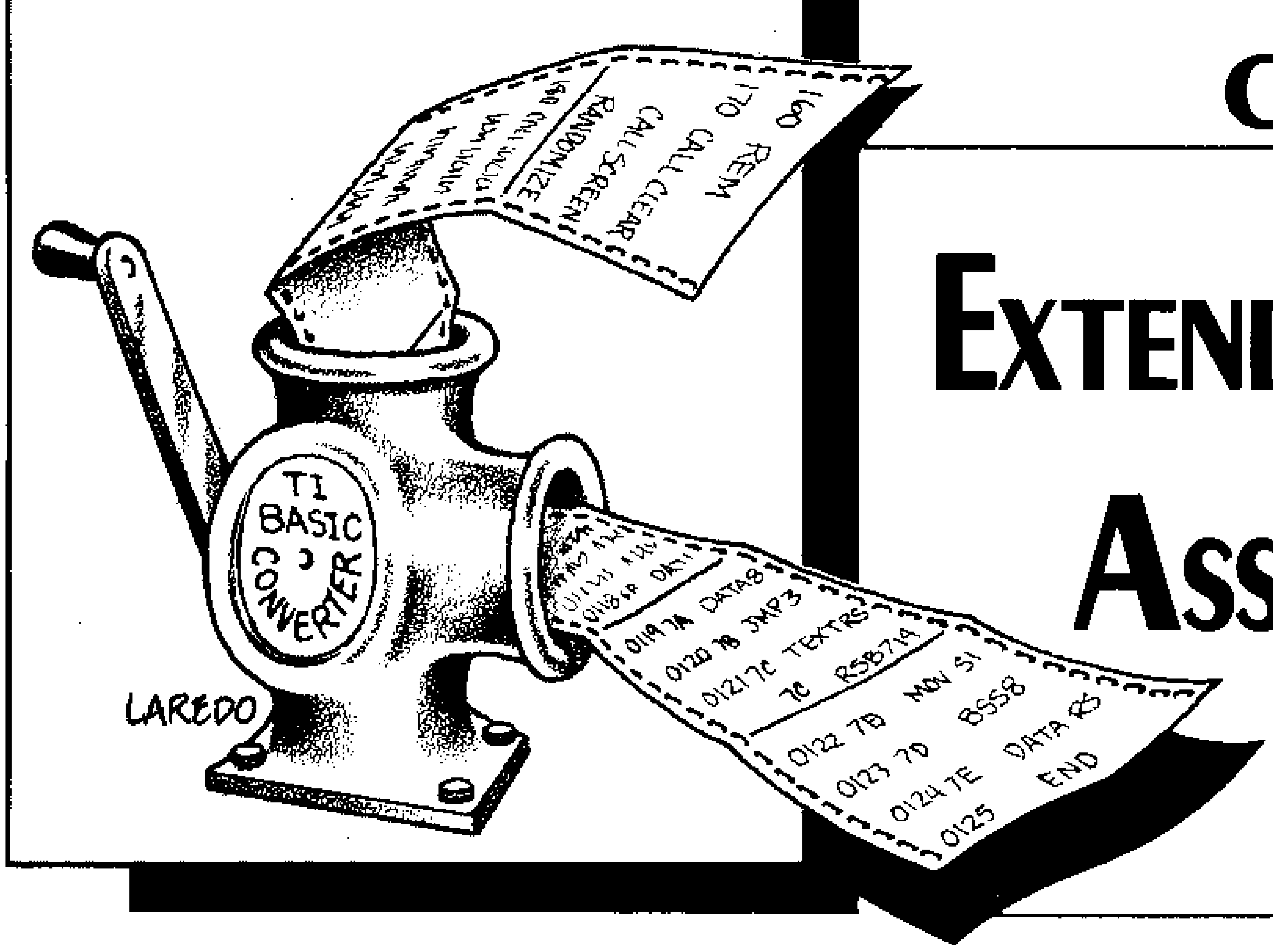
American industry has been presented with problems before, and it has always managed to find solutions. Now it is faced with a problem totally unforeseen: The underdeveloped nations are producing more products at a cost lower than our factories could even dream of. As these countries develop their industry, they will most assuredly turn to robotics. The Japanese did it in the 1960's and they now have the most efficient manufacturing facilities in the world. The problem we face is that our factories were built without the robot in mind. It will take an enormous amount of money to bring robotics to our factories, but this is not a question of greater efficiency or higher profits; it is a question of do or die.

Robots could help rid this country of many of its problems. For example, with robotics making factories more efficient, the cost of manufactured items will drop—helping to curb inflation. And the number of people needed to build, program, and repair the millions of robots that will eventually be on the market should do much to shorten the unemployment line.

The Future

Someday robots will be everyday applicances, and people will pay no more attention to them than they do the refrigerator. They will forget what life was like before the robot. Most of us can't imagine what it would be like to till a field with a plow horse, or spend six months on a wagon train just to move across the country. So, too, will people forget what it was like to have to clean the house all day, or cook meals, or wash the dishes. And with these mundane tasks relegated to their new mechanical assistants, maybe people will finally have the time to explore the various creative paths that can lead to personal fulfillment. 99'er





CONVERTING

EXTENDED BASIC TO ASSEMBLY LANGUAGE

By Jerry Spacek
5407 Salem Hill
Austin, TX 78745

Language translation is never a simple matter. Moving from Extended BASIC to a language on a lower level, such as 9900 Assembly Language, presents a special challenge. There are, however, commonalities between the two languages that can greatly lessen the effort.

The major features common to both languages are their sprite capabilities. Extended BASIC is well known for its fantastic arcade-like graphics; its clear instructions and smooth-moving sprites can be used to create all kinds of games. TMS9900 Assembly Language offers greater speed and requires far less memory, but its instructions are much more difficult to work with.

Writing a game in Assembly Language can be a very challenging task. If you want to create an arcade-like action game, it might be easier to write it first using an easy language like Extended BASIC. Put in all the features and strategy you can think of and grind out all the bugs. Then, when all that work is finished, you can concentrate on changing the game to the more powerful Assembly Language.

This is what I did when I first received my Editor/Assembler Module. I had already written *Defend the Cities,* a nice arcade game in Extended BASIC. Rather than try to create an Assembly game from scratch, I decided that it would instead be good practice to *duplicate* the game in Assembly. Ultimately, I wanted to reduce the program size to 4K bytes so it could fit into the Mini Memory Cartridge (in effect creating my own Command Cartridge).

> **"All you need is a cassette recorder, the TI-99/4A, and the Mini Memory Cartridge to run fast arcade games."**

This article will show the advantages of each language, as well as some surprising similarities between them. It will give some program translation examples and some general tips. Finally, it will show some tricks for reducing the size of a program.

Speed is Desirable

TI Extended BASIC language offers many simple and powerful statements that are easy to use. But the cost of this luxury is high. Having the computer *interpret* each statement of a program before it *executes* takes a great amount of time. The result can be a well-designed computer game with slow reaction time.

Defend the Cities was just such a program—a sophisticated game that involved many complex algorithms, all of which were handled easily by Extended BASIC commands. But the price came high. At the game's lower difficulty levels, reaction time was reasonably good, since there were few enemy targets. But at higher levels with more targets to be monitored, the program reaction time slowed down. Of course, slow responses are not necessarily bad in themselves: In this case, the game's difficulty also increased a bit, forcing the player to plan his shots more carefully. Nevertheless, faster responses are generally more satisfying for game players.

Advantages of Assembly Language

When it comes to games programming, 9900 Assembly Language makes for the ultimate in quick response. It is so fast that some routines programmed in Assembly Language must be slowed down with a *delay loop,* just so humans can follow them. Add all of the sprite capabilities of Extended BASIC, and you have unlimited arcade game possibilities.

Keeping these possibilities in mind, I came up with an Assembly Language version of the game (*Defend the Cities II*). The second game offers the player *instantaneous* response time for all game control keys, including those for firing missiles and maneuvering the spaceship.

Assembly Language provides the new game with all of the graphics and sprite features contained in the Extended BASIC version. Complex hit-target, acceleration, and collision routines are performed at such lightning speeds that no noticeable delay can be detected by any of the key functions.

In addition to speed advantages, Assembly Language programs use less computer memory. The new version of *Defend the Cities* occupies less than 4K bytes of memory, whereas the game in Extended BASIC occupies more than twice that amount. You can load the Assembly Language game (from cassette or disk) into TI's Mini Memory Cartridge; expensive disk peripherals are not necessary. All you need is a cassette recorder, the TI-99/4A, and the Mini Memory Cartridge to run fast arcade games.

Game Program Construction

The building of a program involves much more than just writing the *source code.* Equal in importance is the *designing* of the game. This includes all program considerations, from hardware restrictions to game strategy. Developing design features takes a great deal of time. They often change many times while the program is being tested. Because all design features of the finished Extended BASIC program will be exactly the same for the new Assembly program, the programmer need only make a mechanical *coding* translation to save much work.

There are many program parts that will remain the same. For example, all of the graphic character definitions can be taken directly from the Extended BASIC version of *Defend the Cities.* The 16-digit character patterns for the buildings, clock tower, tower light, and stars all remain exactly the same. Of course, they must be loaded in a different manner than in Extended BASIC. The same is true for the sprite definitions. The 16-digit

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patterns for the ships, bombs, missiles, and explosions remain unchanged.

All the mathematical algorithms also stay the same. It is simply a matter of expressing the same mathematical relationships in another language. Algebraic formulas for calculating missile angles, bomb altitudes, and sprite collisions logically stay the same.

All the colors chosen for the screen, sprites, and graphics remain the same. The only difference is that the Extended BASIC colors are numbered 1 through 16 (for transparent through white), while Assembly uses >0 to >F hexadecimal notation.

Text for prompt messages remains, of course, unchanged. Messages describing skill and difficulty levels, high score, and copyright information are identical. Also, messages are displayed in the same locations.

All ranges of random numbers stay the same, although the method for creating them is more difficult. The ranges of random positions for stars on the screen, height of buildings, and positions of bombs need not be changed. This saves much time, since these decisions can be made only after time-consuming experimentation and testing of the full random number range.

Assembly is Like a Foreign Language

As you can see, there are many pieces of an Extended BASIC game program that can be used directly in the Assembly version. Since the design remains the same, work is reduced to a straightforward mechanical translation from one language to another. Unfortunately, instructions in Extended BASIC are unlike any instructions in Assembly.

The problems are similar to those found in translating English to a foreign language—sometimes there is no word that translates directly to the same meaning. So you are forced to describe the situation using many other words with similar meanings until your point is made. This is similar to what happens with computer languages. Assembly is simply a very different language from Extended BASIC. And there are no instructions in Assembly that have the same meaning. Therefore, you must use many Assembly instructions to emulate a single Extended BASIC instruction.

DISPLAY AT

One of the first problems I ran into was how to display a message on the screen in Assembly Language. Extended BASIC uses a single statement:

```
100 DISPLAY AT (3,1): "Defend the Cities"
```

Assembly Language is a bit more difficult. You have to know how the computer creates the screen. First of all, to the computer there is no such thing as a *screen;* there are just memory locations. The TI 99/4A hardware defines the screen as sequential memory locations 000 through 767. There are no rows and columns. There are only 768 possible character locations in a long string. Therefore, in Assembly Language, rows and columns must be handled algebraically.

figure 1

```
000  001  002  .  .  .  .  .  .  .  .  .  031
032   .    .   .  .  .  .  .  .  .  .  .  063
064   .    .   .  .  .  .  .  .  .  .  .  095
 .                                         .
 .                                         .
 .                                         .
 .                                         .
 .                                         .
736   .    .   .  .  .  .  .  .  .  .  .  767
```

The 768 positions must be broken up into 24 groups of 32 to represent 24 rows (0-23) worth of 32 columns (0-31) as shown in Figure 1. If you want to change a character on the third row (row 2) in the first column (column 0), you can find that position in the string by multiplying and adding (2 x 32 + 0 = 64). This position could be the first letter of a message you want displayed at the beginning of the third row of the screen:

```
0010   ADDR   Text    'Defend the Cities'
0100          LI      R1,ADDR
0101          LI      R0,64            (2x32) + 0
0102          LI      R2,17
0103          BLWP    @VMBW
```

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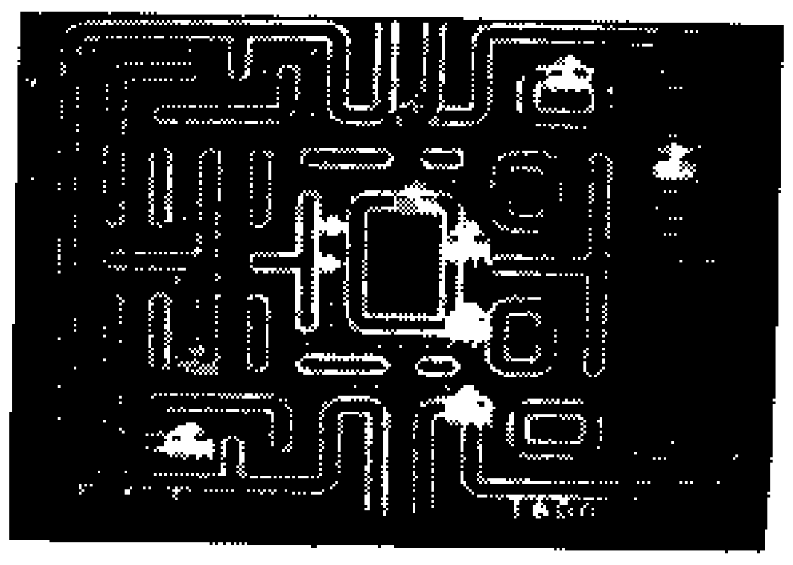

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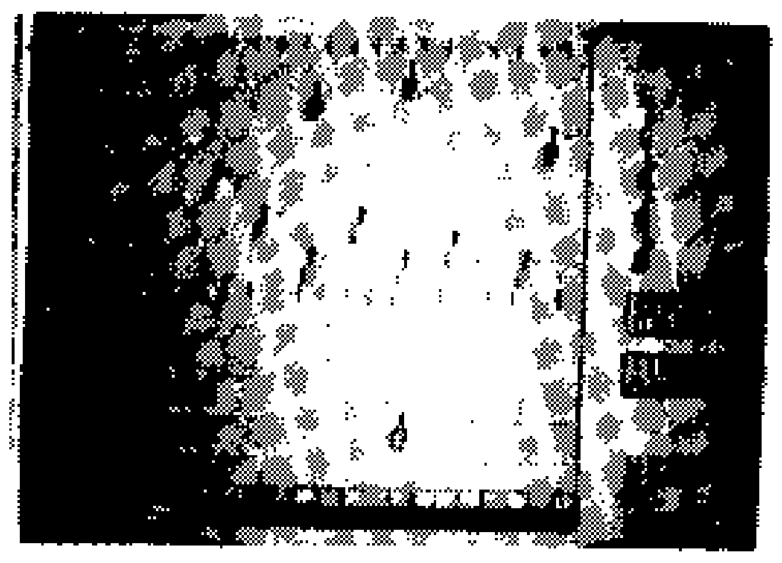

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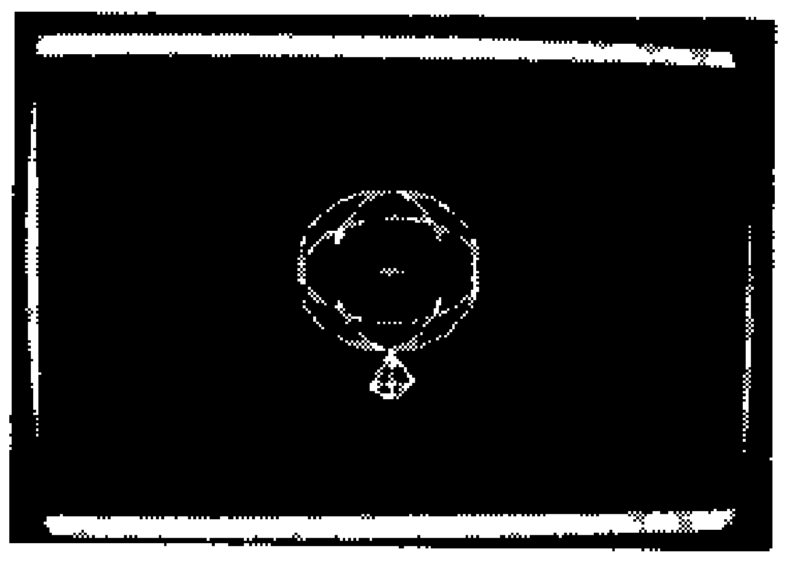

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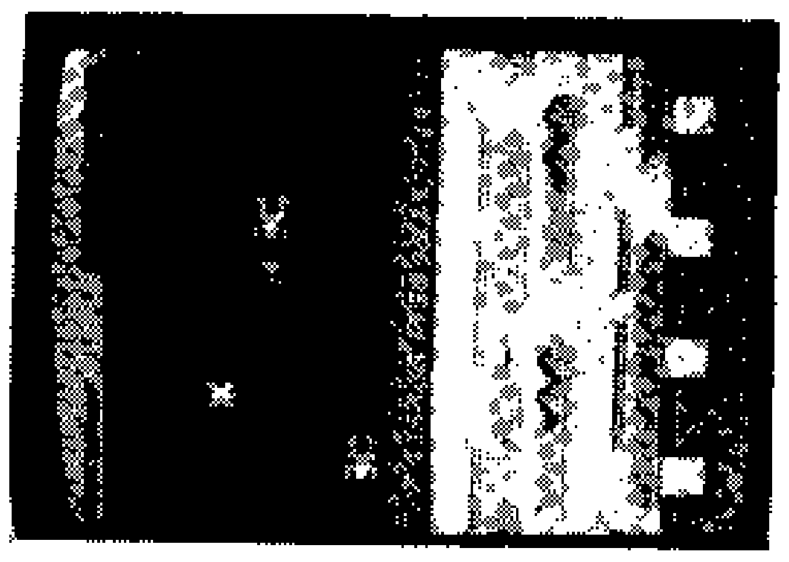

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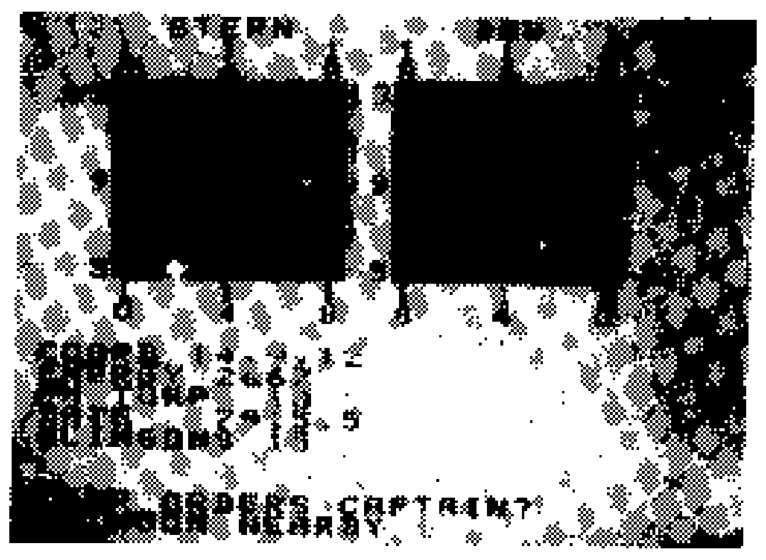

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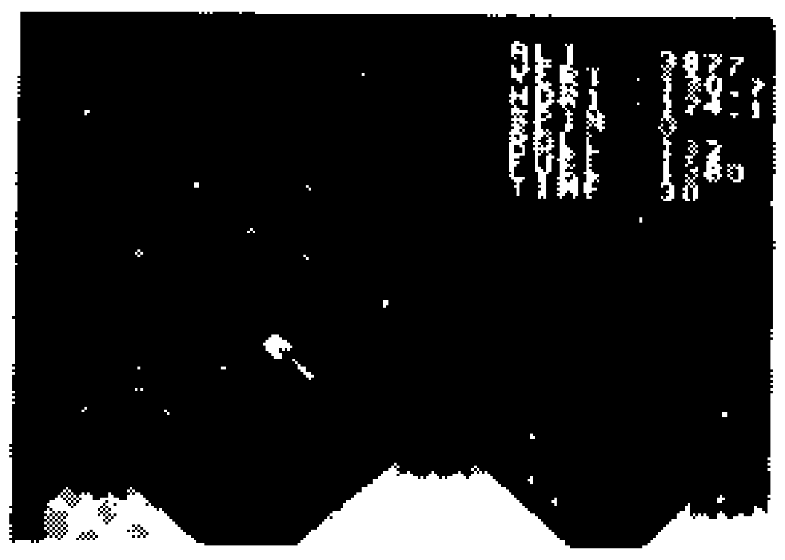

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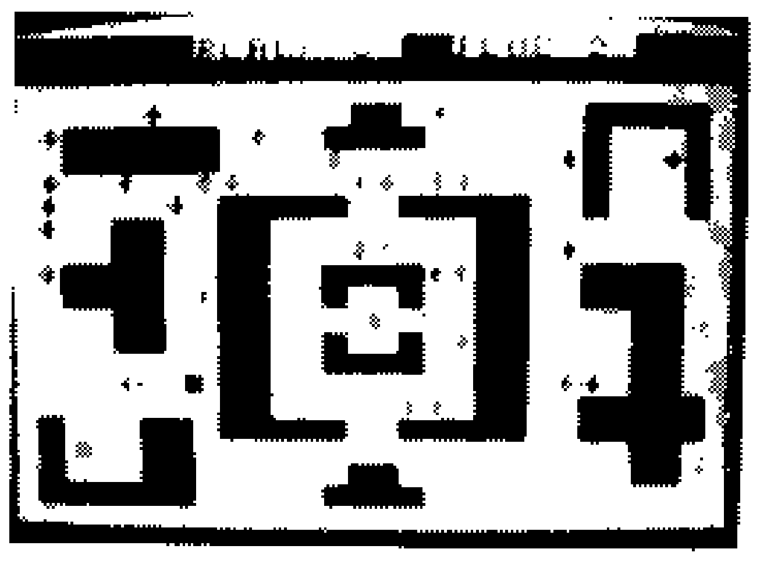

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DEALER INQUIRIES WELCOME

Line 0010 above assigns the *address* of the message to the label ADDR. This *address* is passed to the utility routine VMBW (VDP Multiple Byte Write) in register 1 (set up in line 0100). Line 0101 sets register 0 to the starting position in memory that VMBW will write into. Line 0102 sets register 2 to the length of the message to be written. Line 0103 causes the utility VMBW to fill memory locations 64 through 81 with the letters (bytes) defined at the address labeled ADDR. Immediately, as the memory is filled, the message is displayed on the screen. This is a good example of Assembly Language speed. It can display an entire screen of information faster than Extended BASIC can show a single line.

After you learn to display messages on the screen, you must learn how to remove them. One method would be to simply *cover* the messages with blanks. Extended BASIC would again use a single statement:

```
100 DISPLAY AT (3,1) "                 "
```

Assembly Language would define a message made out of 17 blanks and use the same coding to cover up the message:

```
0010    BLNK17  TEXT    '                 '
0100            LI      R1,BLNK17
0101            LI      R0,64           (2x32) + 0
0102            LI      R2,17
0103            BLWP    @VMBW
```

CALL CLEAR

Another method to clear the message would be to clear the entire screen. Extended BASIC uses a single statement:

```
100 CALL CLEAR
```

Assembly Language does not a have nice command like that. Several instructions can be used in a looping routine to accomplish the same thing:

```
0100            LI      R0,0
0101            LI      R1,>2000
0102            LI      R3,767
0103    LOOP    BLWP    @VSBW
0104            INC     R0
0105            DEC     R3
0106            JGT     LOOP
```

This routine executes the VSBW (VDP single byte write) utility to move blanks one at a time into the 768 memory positions of the screen. Line 0100 sets up the first position that will receive a blank. Line 0101 sets a blank into the left-most side of register 1, and VSBW does not use the entire contents of register 1. A blank is represented by character 32 in decimal, but here it must be written in its hexadecimal form as >20. Line 0102 sets the counter that tells the routine when all 768 positions have been filled with blanks. Line 0103 is the beginning of the repeating 'loop. This line also executes the VSBW utility. The first time through, a blank will be placed at memory location 000. Line 0104 then increments the VSBW utility to point at location 001 for the next blank. Line 0105 then decrements the loop counter to 766 to be checked in Line 0106. If the loop counter is greater than zero, Line 0106 says to jump back to Line 0103 and to blank out the next location. The loop repeats 768 times, placing a blank in locations 000 through 767.

As you can see, Assembly Language is flexible enough to clear a message in many different ways, depending on different situations and programming styles.

Let's look at how each language handles IF statements: Extended BASIC goes for simplicity:

```
100 IF CITY=5 THEN CITY=1 ELSE CITY=CITY+1
```

Assembly Language strives for flexibility:

```
0010    CITY    DATA    0000
0011    FIVE    DATA    0005
0012    ONE     DATA    0001
0100    START   C       @CITY,@FIVE     IF CITY=5
0101            JEQ     CITY5           THEN CITY5
0102            A       @ONE,@CITY      ELSE CITY=CITY+1
0103            JMP     FIN
0104    CITY5   MOV     @ONE,@CITY      CITY=1
0105    FIN     NOP
```

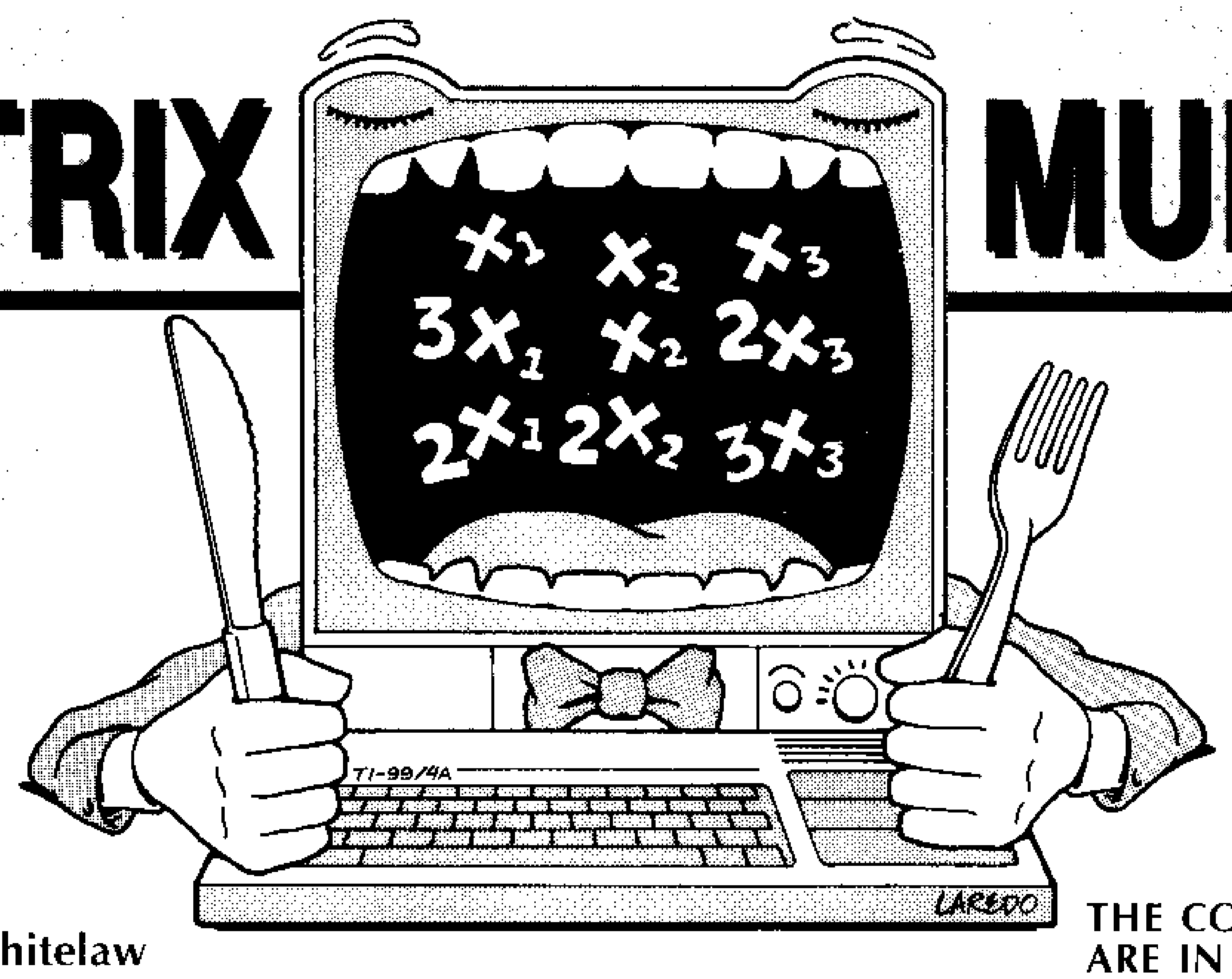
FOR NEXT

A sequence used frequently in programs is the FOR NEXT loop. Extended BASIC begins and ends with a line of coding:

```
100 FOR DELAY=1 TO 300 : : NEXT DELAY
```

Continued on p. 58

MATRIX MUNCHE



Make Your Home Computer A Magic Math Machine

A Program By Cheryl Whitelaw
And 99'er HCM Staff

This rather short TI BASIC program will be useful to a wide variety of people. High school students, engineers, scientists, and technicians often run into math problems having several unknowns. But these unknowns will usually be related in several ways—in relationships that can be expressed with mathematical equations. When these equations are solved simultaneously, the values of the unknowns are often discovered.

The paper-and-pencil method of solving simultaneous equations (usually learned in high school algebra and soon forgotten) is time consuming and error prone. But *Matrix Muncher* can work through the solution of simultaneous equations for you. It can handle up to nine unknowns (and equations). All you do is produce the equations that represent the relationships between the unknowns.

A Simple Example

Let's assume three relationships between three unknowns have already been determined for us; it is now time to use *Matrix Muncher* to find the values of the unknowns. The three equations are:

$$\begin{aligned} X_1 + X_2 + X_3 &= 9 \\ 3X_1 + X_2 + 2X_3 &= 16 \\ 2X_1 + 2X_2 + 3X_3 &= 21 \end{aligned}$$

The information contained in these equations can also be expressed in matrix form, as follows:

$$\begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 2 \\ 2 & 2 & 3 \end{bmatrix} * \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 9 \\ 16 \\ 21 \end{bmatrix}$$

coefficients unknowns constants

In general, for n equations, the matrices can be shown as:

$$\begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & \cdots & A_{2n} \\ \vdots & \vdots & & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nn} \end{bmatrix} * \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix} = \begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_n \end{bmatrix}$$

This is shown in matrix *notation* as [A]*[X]=[B]. *Matrix Muncher* uses a matrix inversion technique in solving for the unknowns.

After loading the program and typing RUN, the following screen is displayed:

```
M A T R I X   M U N C H E R
(MATRIX INVERSION TECHNIQUE
  TO SOLVE [A] * [X] = [B])
ENTER DEGREE OF THE MATRIX,
  OR NUMBER OF EQUATIONS:
N =
```

For our example, we enter the number 3 and press ENTER. The program asks for the coefficients to be entered row by row. The next screen shows the display after we've entered five of the coefficients:

```
  THE COEFFICIENTS OF X
  ARE IN THE "A" MATRIX.
A(1,1),A(1,2), . . . ,A(1,N)
A(2,1),A(2,2), . . . ,A(2,N)
.                          .
.                          .
.                          .
A(N,1),A(N,2), . . . ,A(N,N)
  INPUT THE MATRIX VALUES
  ROW BY ROW:
   A(1,1) = 1
   A(1,2) = 1
   A(1,3) = 1
   A(2,1) = 3
   A(2,2) = 1
   A(2,3) =
```

After we've entered all values of
coefficients, the values of the consta
(Bx) are requested by *Matrix Munc*

```
  ROW BY ROW:
   A(1,1) = 1
   A(1,2) = 1
   A(1,3) = 1
   A(2,1) = 3
   A(2,2) = 1
   A(2,3) = 2
   A(3,1) = 2
   A(3,2) = 2
   A(3,3) = 3
NOW INPUT ELEMENTS OF B:
   B(1) = 9
   B(2) = 16
   B(3) =
```

When the last value of the B matrix
been entered, the Magic Math Mach
goes to work:

```
         M U N C H
         M U N C H
         M U N C H
SOLUTION VALUES ARE:
  X(1) = 2
  X(2) = 4
  X(3) = 3
**DONE**
>
```

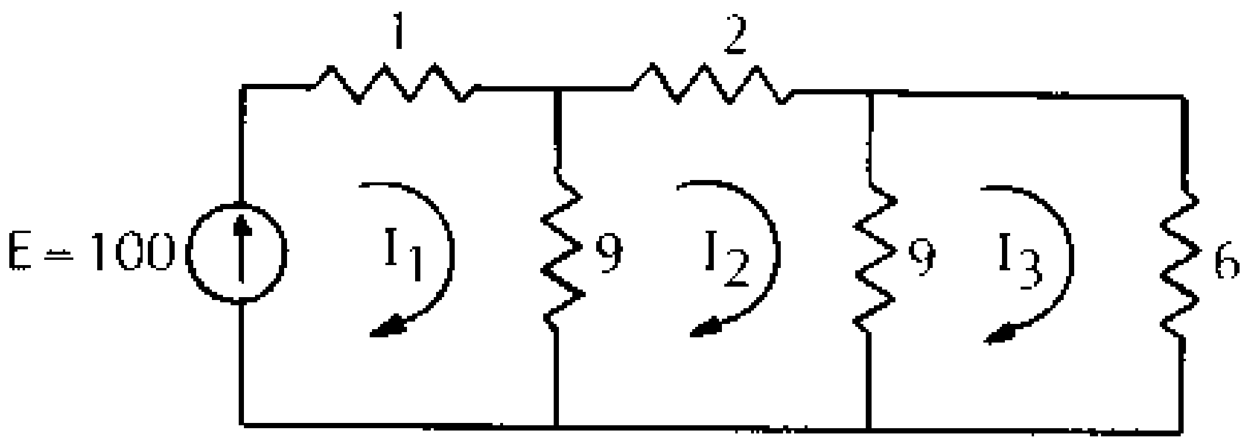
Each major step completed in the
gram causes the word "MUNCH"

scroll on the screen. After the unknowns have been found (or *Matrix Muncher* discovers that no unique solution exists), the results are displayed as above.

Go ahead—check the answers in the original three equations and see if they work . . .

A Real Life Example

Electrical engineering applications include solving networks for voltages and currents. Here is a simple example using loop equations to solve for currents in a network. The sum of the voltages around a loop must be zero, according to Kirchoff's voltage law.



Given the network above, find the currents. The loop equations are:

Loop 1: $-100 + 1I_1 + 9I_1 - 9I_2 = 0$
Loop 2: $-9I_1 + 9I_2 + 2I_2 + 9I_2 - 9I_3 = 0$
Loop 3: $-9I_2 + 9I_3 + 6I_3 = 0$

Combining terms and rearranging,

$$\begin{aligned} 10I_1 - 9I_2 \phantom{{}-9I_3} &= 100 \\ -9I_1 + 20I_2 - 9I_3 &= 0 \\ -9I_2 + 15I_3 &= 0 \end{aligned}$$

or in matrix form,

$$\begin{bmatrix} 10 & -9 & 0 \\ -9 & 20 & -9 \\ 0 & -9 & 15 \end{bmatrix} * \begin{bmatrix} I1 \\ I2 \\ I3 \end{bmatrix} = \begin{bmatrix} 100 \\ 0 \\ 0 \end{bmatrix}$$

Once this information has been fed in, *Matrix Muncher* will produce the following values for the unknowns:

$$I1(X_1) = 22.46$$
$$I2(X_2) = 13.85$$
$$I3(X_3) = 8.31$$

You will find that the *Matrix Muncher* is faster than the pencil by many orders of magnitude.

EXPLANATION OF THE PROGRAM
Matrix Muncher

Line Nos.	
100-150	Header remarks.
160-190	Clears screen and prints program title.
200-240	Asks for the number of equations, N.
250-270	Makes sure N is between 1 and 10.
280-330	Prints input instructions.
340-470	Receives user's input of values for the A matrix and B matrix. Z is a work matrix and is initially set equal to the A matrix.
480-660	Calculations to invert matrix.
670-760	Multiplies inverse matrix by constant vector to solution vector; prints results.
770-910	Subroutine to interchange rows if a diagonal element is zero.
920	End.

```
100 REM  ********************
110 REM  * MATRIX MUNCHER   *
120 REM  ********************
130 REM   BY CHERYL WHITELAW AND 9
    9'ER STAFF
140 REM  99'ER VERSION 2.5.1
150 REM
160 OPTION BASE 1
170 DIM A(9,9),X(9),B(9),Z(9,9)
180 CALL CLEAR
190 PRINT "M A T R I X   M U N C H
     E R"::::
200 PRINT "(MATRIX INVERSION TECHN
    IQUE"::
210 PRINT " TO SOLVE [A] * [X] = [
    B] )":::
220 PRINT :"ENTER DEGREE OF THE MA
    TRIX,":""
230 PRINT "OR THE NUMBER OF EQUATI
    ONS:"::
240 INPUT "N = ":N
250 IF (N<10)+(N>1)=-2 THEN 280
260 PRINT "N MUST BE 1<N<10"::
270 GOTO 240
280 PRINT :::::::" THE COEFFICIENT
    S OF X"
290 PRINT " ARE IN THE ""A"" MATRI
    X."
300 PRINT :"A(1,1),A(1,2),...,A(1,
    N)"
310 PRINT "A(2,1),A(2,2),...,A(2,N
    )"
```

Continued on p. 67

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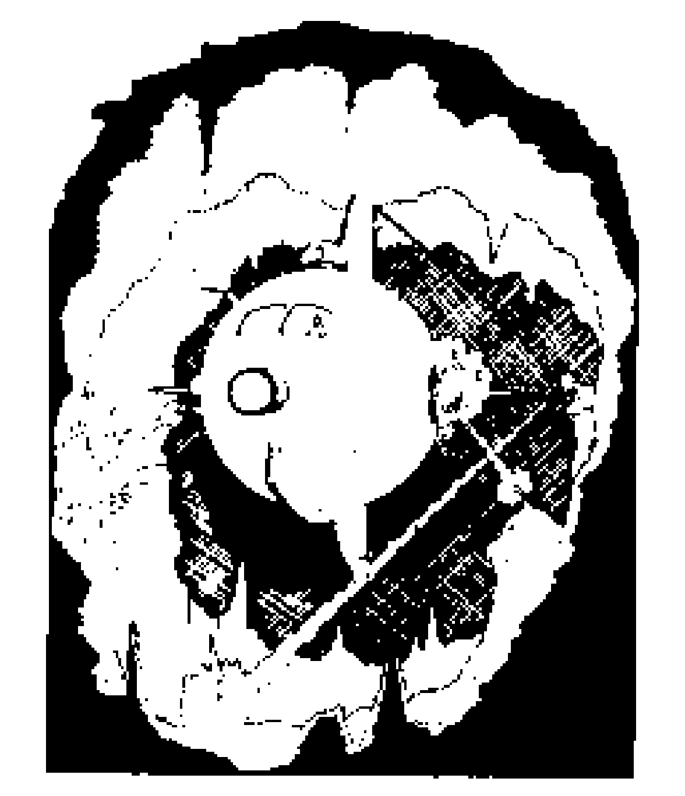

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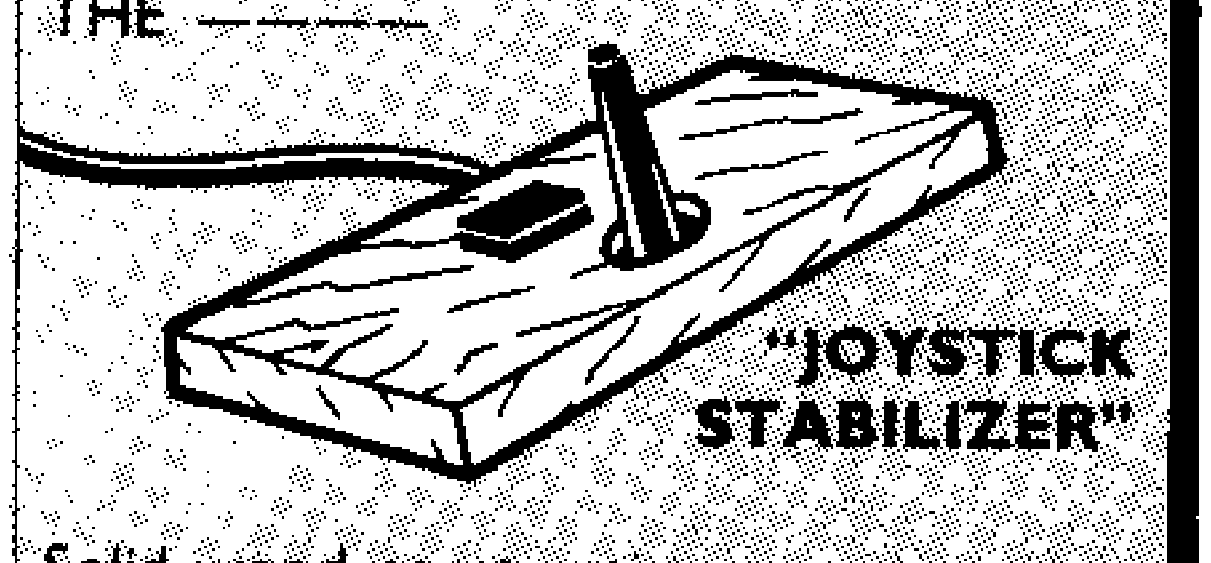

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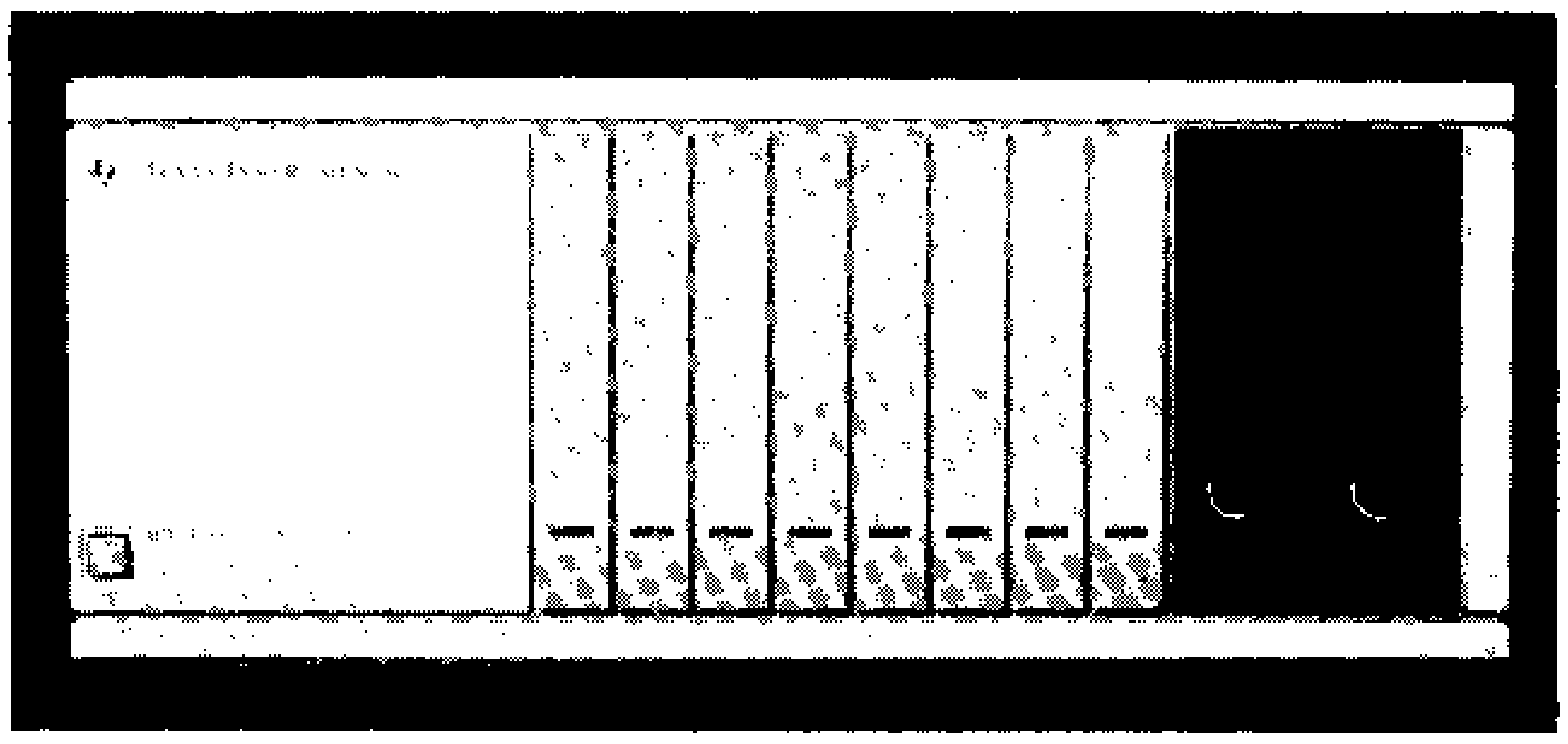

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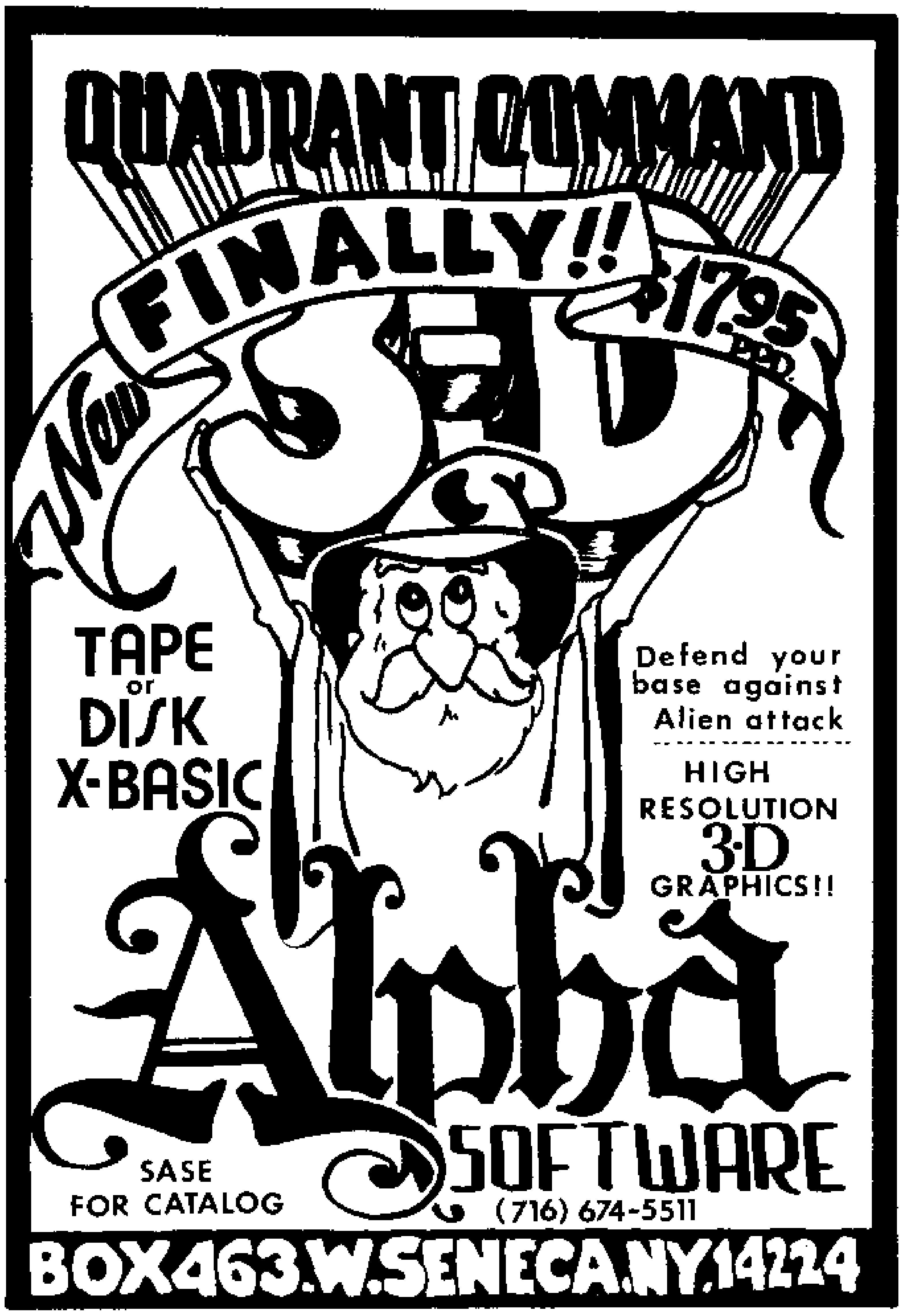


CONVERTING . . . from p.55

Assembly Language is more abstract:

```
0100            LI      R1,1
0101            LI      R2,300
0102    LOOP    C       R1,R2        FOR 1
0103            JEQ     FIN          TO 300
0104            INC     R1
0105            JMP     LOOP         NEXT DELAY
0106    FIN     NOP
```

The following is a small list of some Extended BASIC instructions and their similar Assembly counterparts that I used in translating *Defend the Cities*. Notice again the flexibility that Assembly Language offers over Extended BASIC by having more than one coding alternative:

XBASIC	ASSEMBLY
GOSUB	BL,BLWP
GOTO	B,JMP
REM	*
ACCEPT AT	KSCAN
CALL KEY	KSCAN
CALL JOYST	KSCAN
RETURN	RT,RTWP
=	JEQ
-	S,DEC
+	A,INC
>	JGT
<	JLT
*	MPY
/	DIV

This list does not include any instructions used in handling sprites. Assembly Language sprites are created in a completely different way from Extended BASIC sprites and are beyond the scope of this article.

A Tight Fit

After having accomplished the formidable task of generating an Assembly Language program with the Editor/Assembler Module, the next job is equally challenging: How can you squeeze the perfect-the-way-it-is program into the 4K RAM of the Mini Memory Cartridge? Success at this endeavor will enable you to effectively *build your own* Command Cartridge.

To give you some idea of what is possible, my task was to reduce my game from 4600 bytes to just under 4K. The RAM I actually found available in the Mini Memory Cartridge was 3798 bytes. Amazingly, I was able to cut out over 800 bytes (17 percent) just by using the tricks and techniques in this article. But I will admit that at first those last few hundred bytes seemed impossible to cut.

The trick is to never give up. You will be amazed at what you can do when you start getting close to the magic number of 3798. Just when you are about to quit, 20 or so bytes will jump right out of your listing.

Go for all the bytes you see, no matter how small. They add up quickly. Write down or mark the coding for every idea as you think of it, especially if you are in the middle of coding another idea. By the time you assemble and test the first idea, chances are you will have forgotten the one that could give you the bytes you need.

The first thing you should do is establish some sort of backup system for your source code files (if you are not already using one). Before you start tampering with your code, make sure you can *fall back* to a working copy of your program. There is a good chance you may take out coding that looks useless but is actually a vital part of some forgotten routine. Don't keep making changes to the same source file. After you finish a few changes, SAVE your new source code onto another disk.

Once you have established backups, you can begin to experiment. The easiest coding instructions to eliminate are NOPs. They are sometimes used as branch or jump target addresses when you want to skip over coding lines to the end of a routine. From the NOP line, the program then *falls into* the first line of the next routine. Only when your program is completed (and you are sure you will not want to insert a new routine between the first and second), can you branch or jump directly to the second routine rather than the NOP line of the first routine.

Use Subroutines and Loops

The best way to save memory is to use BL (Branch and Link) and the BLWP (Branch and Link with Workspace Pointer) instructions. Look carefully through your source listing for any routines that are doing the same thing. Clearing the screen is a good example. You may be displaying many messages and clearing the screen after each one. Rather than duplicate the clearing code many times, simply make a common accessible routine and apply BLWP to it. BLWP uses only four bytes:

```
0010    BLWP    @CLEAR
```

Elsewhere in your program you can code the Clear subroutine in order to save bytes. Here is a sample Clear routine:

```
0100    CLEAR   DATA    CLRWS,CLRSTR
0101    CLRWS   BSS     32
0102    CLRSTR  LI      R0,0
0103            LI      R1,>2000
0104            LI      R3,767
0105    LOOP    BLWP    @VSBW
0106            INC     R0
0107            DEC     R3
0108            JGT     LOOP
0109            RTWP
```

Sometimes you may find duplicate coding within a large routine that can be eliminated by using a looping counter.(See R3 in the above example.) Even if a loop is taken only twice, there still might be substantial coding saved. So, look for duplication not only among small routines, but also inside the large ones.

Nitty Gritty Tricks

Another trick that saves memory is to change all branches (B) to jumps (JMP). Branches use 4 bytes whereas jumps use only two. Two bytes may not seem like much, but you might use a branch 20 or 30 times, and believe me 40 to 60 bytes is a nice chunk to find. If your jumps are too long, you may get an "out of range" Assembly error. This just means that you are trying to jump to an address that is too far away. In that case, you *must* use the branch instruction which can address any location in the program.

Another way to save bytes is to look for consecutive BL's to VSBW or VMBW routines. Each time you use one of these routines you must load registers R0, R1, and (in VMBW) R2. (See the previous clear screen example.) Try to find consecutive routines that may use the same value for these registers. Because VSBW and VMBW do not destroy them, you need only load (LI) them the first time. You can then delete the other instructions that load the same value and thereby save 4 bytes a shot. This one is really scraping the bottom of the barrel, but 4 bytes are 4 bytes.

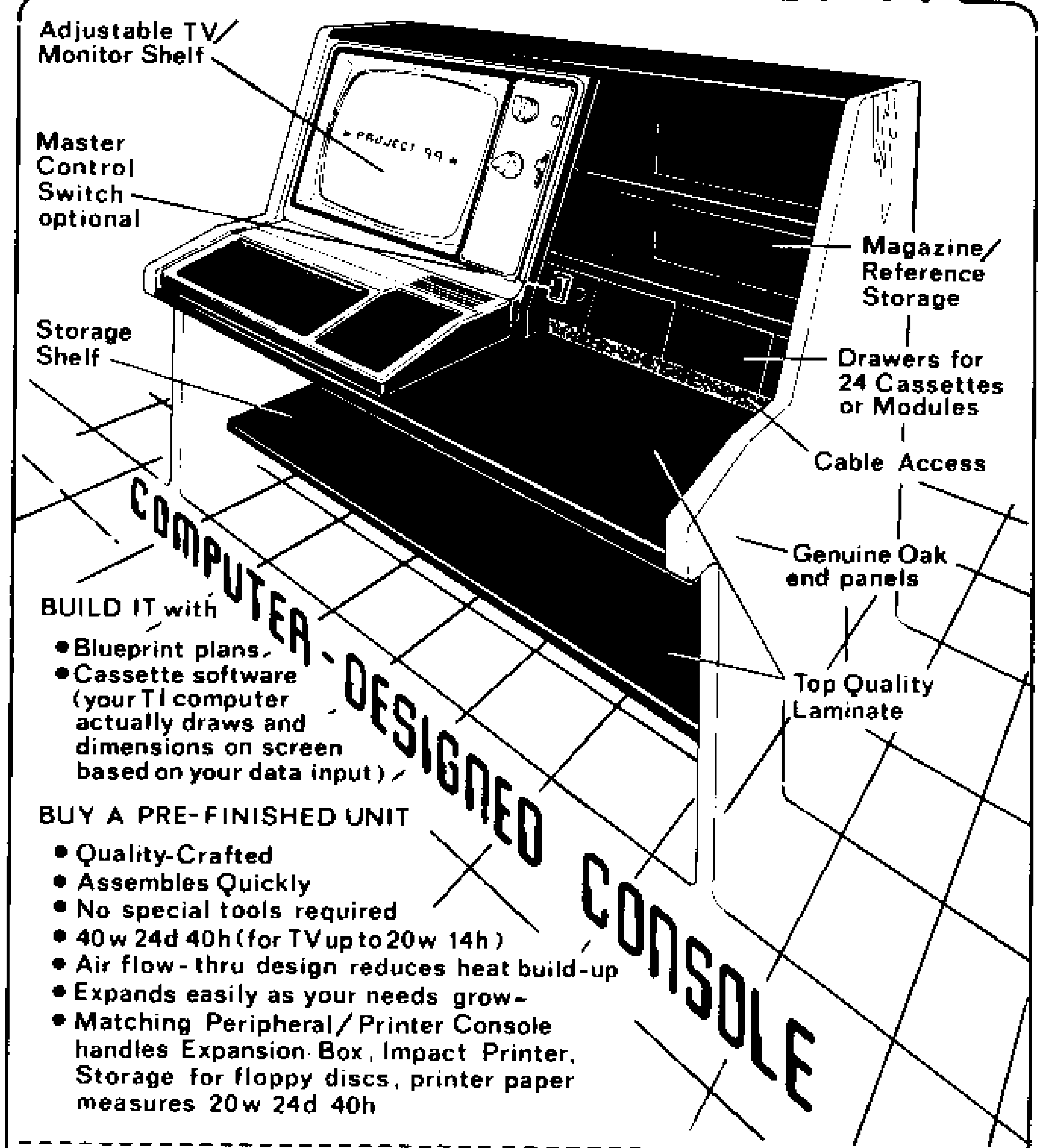
Finally, here is a trick that will save memory in big 32-byte chunks. Each time you construct a BLWP routine (see the clear screen example), you must define a work space with a BSS instruction. But there is no need to define a different work space for each BLWP routine. A common work space can be used over and over again, saving 32 bytes each time. Simply define it once in your program and refer to it in each of the data statements of your BLWP routines. For instance, once CLRWS in the clear screen example was defined, it could be used many more times by other BLWP routines. However, do not use this technique in *nested* BLWP routines. A BLWP routine that calls another BLWP routine must have two different work spaces defined simultaneously.

All these techniques should be helpful in squeezing down your program. Be sure to document each change and its location. With a good backup system you can always fall back to an old copy of your program if you accidentally erase a disk, but you may not be able to remember all the places you found.

And make sure you thoroughly test your program after each assembly. Test *all* the features, not just the ones you changed. You may have inadvertently touched another routine and destroyed its logic. The best procedure is to assemble just a few changes at a time. This will prevent you from accidentally introducing unknowns into your code.

[Editor's note: We published a thorough review of the commercial versions of *Defend the Cities* (available from Intersoft) in the November, 1982 issue of *99'er*.

PROJECT 99



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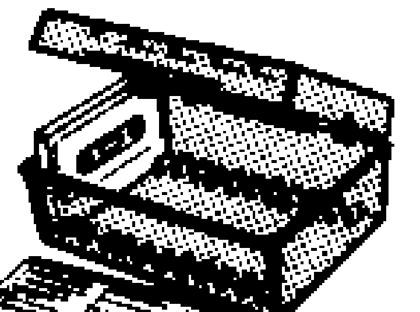

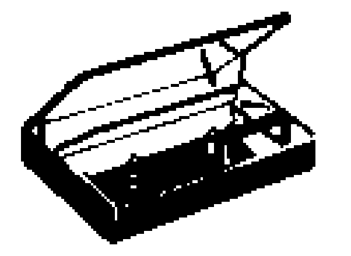

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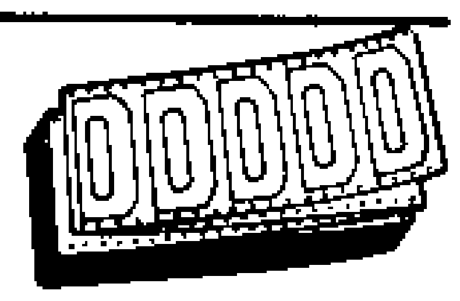

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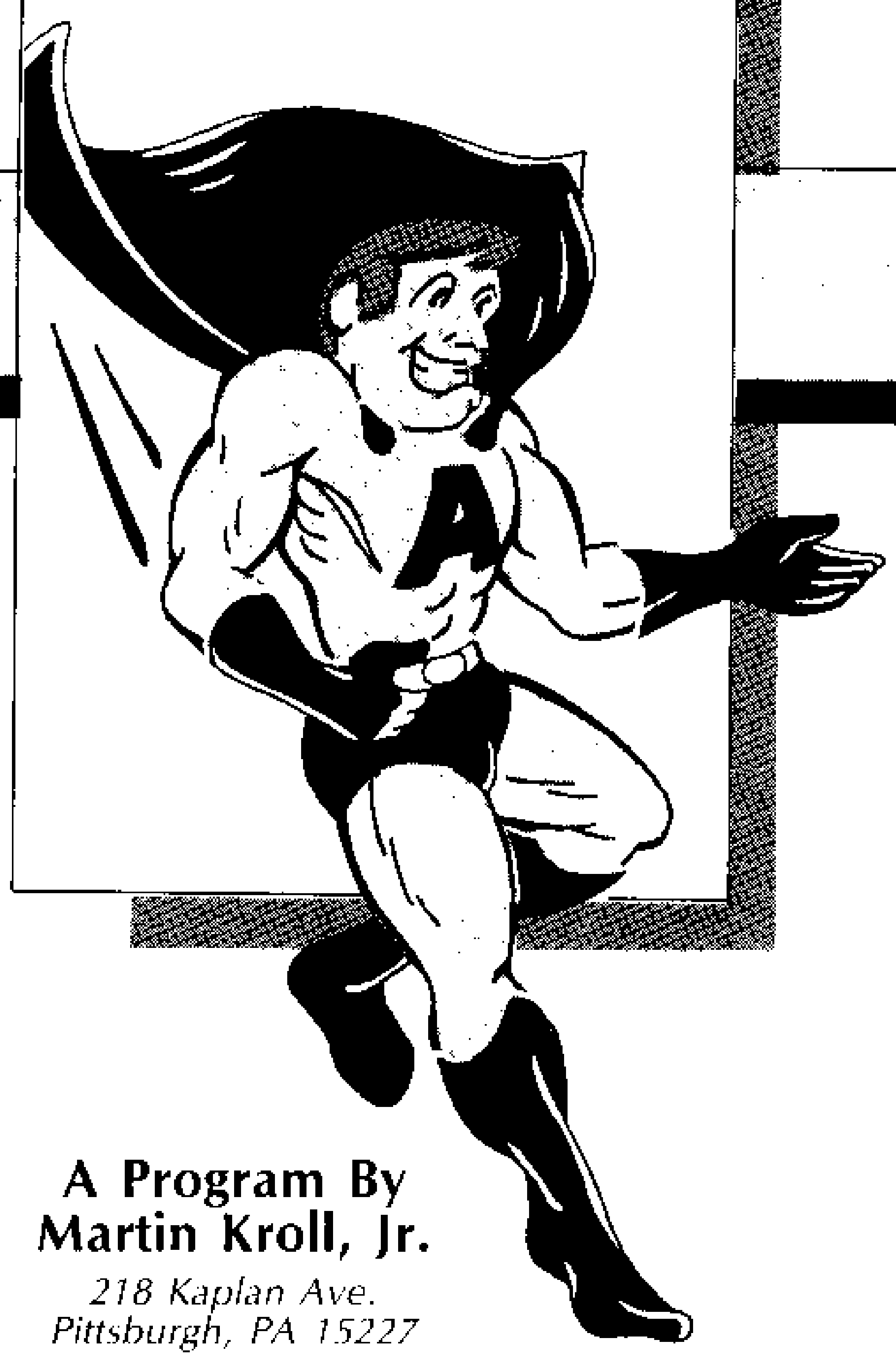

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A Program By
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Have you ever tried entering an Assembly Language program line by line into the Mini Memory cartridge only to find it doesn't work? Somewhere you typed in a wrong operation code . . . and you find yourself re-entering the entire program because you have no idea where the error is. That is the reason we on the 99'er staff were so pleased to see a program submitted for publication that can, if used properly, ease most of the pain: a disassembler written in TI BASIC that runs with the Mini Memory plugged in. And if you have an RS232 interface and a printer, you will be able to produce a hard-copy listing (or screen listing, without a printer) of the original Assembly Language. This *source* listing can then be studied to locate the error(s).

Here's the way it works: Once an Assembly Language program is "assembled" into machine code (the binary patterns on which the computer makes its decisions), it becomes very difficult for humans to read. Therefore, when debugging, it is a great help to convert this machine code into something we can understand. The disassembler program does just this by translating the machine code ("object") back into Assembly Language ("source") mnemonic statements. For example:

MACHINE CODE	ASSEMBLY LANGUAGE
>04C0	CLR R0

The ">" in the machine code simply means the value following it is hexadecimal (base 16). The Assembly Language mnemonic statement makes much more sense: "CLR R0" means CLeaR Register zero. The disassembler reads the value >04C0, determines the type of mnemonic code it is represented by, and prints the Assembly Language statement on the printer or screen.

The Program

Make sure your Mini Memory cartridge is loaded with the software you wish to disassemble, and that the cartridge is properly installed in the TI-99/4A. After loading the disassembler program under TI BASIC, type RUN. The message "WANT A PRINT OUT? Y/N" is displayed. Press Y and ENTER if you have a printer (N, if you want to display the disassembled code on the screen). The next message "DEVICE NAME?" is displayed if you chose Y. Enter the parameters for your printer. (For example, RS232.BA=9600.DA=8.) Once this is done, the master option screen appears:

1. DISASSEMBLE OPCODE
2. DISASSEMBLE DATA
3. DISASSEMBLE TEXT
4. FINISH

If option 1, 2, or 3 is selected, the message "DISASSEMBLE FROM? (4 DIGIT HEX ADDRESS)" is displayed. Enter the starting location in Mini Memory for the segment of machine code you wish to disassemble. The next prompt is "TO? (4 DIGIT HEX ADDRESS)." Enter the last address of the machine code segment. Mini Memory programs may reside anywhere between addresses >7000, and >7FFF. When actually entering the first and last address of the block of memory you wish to disassemble, you do not need to enter the "greater than" sign (>).

If option #1 is selected, the machine code will be interpreted as operation code instructions to the computer. In doing this, whenever the disassembler comes across data or text, either a "pseudo" mnemonic statement will be produced or the message "ILLEGAL OBJECT CODE" will be printed. After running option #1, you can get a good idea of where the data and text is located. Now you can use option #2, or #3.

Option #2 will print all machine code between the start and stop addresses as DATA statements. You will have to coordinate this print-out with the one you generated in option #1 if you do not know where the data is.

Option #3 will print all machine code from the starting to the stopping address in TEXT format. This means that all machine code will be treated as "ASCII" characters. If you try to print machine code in TEXT format which is not *printable text*, a question mark will be output for each non-printable character. Once you are finished disassembling, select option #4 to exit the program.

How It Works

With the Mini Memory installed, you have several new commands at your disposal in TI BASIC. One command which made this program possible is "CALL PEEK". It will return the decimal value of any memory location. Once it has the decimal value of a memory location, the program then converts that value to hexadecimal (base 16), and binary (base 2). The hexadecimal value is used in the printed report. The binary value is used to extract the control fields and operation code to ascertain the format and type of instruction that represents the machine code.

Some final notes: This disassembler cannot reconstruct the "labels" that you have used to mark portions of the program for branch or jump destinations. If you have the TI Memory Expansion, you will also find it possible to disassemble machine code in it with this disassembler utility. All in all, it is a very useful tool. 99er

EXPLANATION OF THE PROGRAM
Mini Memory Disassembler

Line Nos.	
200-280	Initialize array, and set up printer.
290-410	Display main title screen and branch to options.
420-440	Subroutine to wait for Enter to be pressed.
450-580	Input start and stop addresses to be disassembled.
590-660	Get hexadecimal value of addresses.
670-820	Control loop to get a value from memory and convert it back to hexadecimal code.
830-920	Branch to formatting subroutines, depending on the code values.
930-1210	Subroutine to print disassembled listing.
1220-2950	Subroutines for instruction formatting.
1220-1380	Format #1.
1390-1620	Format #2.
1630-1750	Format #3.
1760-1890	Format #4.
1900-2020	Format #5.
2030-2410	Format #6.
2420-2470	Format #7.

Continued on p. 62

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Disassembler . . . from p.60

2480-2780	Format #8.
2790-2950	Format #9.
2960-3120	Convert binary to decimal.
3130-3200	Convert decimal to binary.
3210-3270	Get binary divisor.
3280-3370	Get the "T" field.
3380-3530	Set up operand fields.
3540-3570	Get the mnemonic of the op-code.
3580-3700	Convert decimal to hexadecimal.
3710-3900	Control loop for displaying DATA.
3910-4070	Control loop for displaying TEXT.
4080-4270	Display DATA on the screen.
4280-4440	Display the TEXT on the screen.
4450-4520	Subroutine to "PEEK" at a memory location.
4530	End of program.

```
100 REM  ***************
110 REM  * MINI-MEMORY *
120 REM  * DISASEMBLER *
130 REM  ***************
140 REM  BY MARTIN KROLL
150 REM  99'ER VERSION 2.5.1
160 REM
170 REM
180 REM
190 REM
200 DIM S(15)
210 GOSUB 3210
220 CALL CLEAR
230 INPUT "WANT A PRINTOUT?
     Y/N":PRINT$
240 IF PRINT$<>"Y" THEN 290
250 F=1
260 PRINT
270 INPUT "DEVICE NAME?
         ":DEVICE$
280 OPEN #1:DEVICE$
290 CALL CLEAR
300 PRINT "PRESS 1 - DISASSEMBLE O
PCODE":"PRESS 2 - DISASSEMBLE
DATA":"PRESS 3 - DISASSEMBLE T
EXT":"PRESS 4 - FINISH"
310 CALL KEY(0,K,ST)
320 IF ST=0 THEN 310
330 IF (K<49)+(K>52)=-1 THEN 310
340 CALL CLEAR
350 IF K=52 THEN 4530
360 GOSUB 450
370 IF K=49 THEN 670
380 IF (K=50)+(F=1)=-2 THEN 3710
390 IF (K=50)+(F=0)=-2 THEN 4080
400 IF (K=51)+(F=1)=-2 THEN 3910
410 IF (K=51)+(F=0)=-2 THEN 4280 E
LSE 4530
420 PRINT ::
430 INPUT "PRESS ENTER TO CONTINUE
:":CON$
440 GOTO 290
450 REM   INPUT PROGRAM ADDRESS TO
 DISASSEMBLE
460 CALL CLEAR
470 INPUT "DIS-ASSEMBLE FROM ?
        (4 DIGIT HEX ADDRESS)
          ":A$
480 IF POS("13579BDF",SEG$(A$,LEN(
A$),1),1)=0 THEN 500
490 A$=SEG$(A$,1,LEN(A$)-1)&SEG$("
0246BACE",POS("13579BDF",SEG$(
A$,LEN(A$),1),1),1)
500 IF LEN(A$)=4 THEN 530
510 PRINT ::"INPUT MUST HAVE 4 HEX
 DIGITS"::
520 GOTO 470
530 INPUT "TO ? (4 DIGIT HEX ADDRE
SS)       ":B$
540 IF POS("13579BDF",SEG$(B$,LEN(
B$),1),1)=0 THEN 560
550 B$=SEG$(B$,1,LEN(B$)-1)&SEG$("
0246BACE",POS("13579BDF",SEG$(
B$,LEN(B$),1),1),1)
560 IF LEN(B$)=4 THEN 590
570 PRINT ::"INPUT MUST HAVE 4 HEX
 DIGITS"::
580 GOTO 530
590 TEMP$=A$
600 GOSUB 2960
610 A=DEC
620 TEMP$=B$
630 GOSUB 2960
640 B=DEC
650 CALL CLEAR
660 RETURN
670 REM  PEEK VALUES & CONVERT
680 FOR LOC=A TO B STEP 2
690 L=0
700 V1=LOC
710 GOSUB 3580
720 LOC$=HEX$
730 GOSUB 4470
740 M=MX
750 N=NX
760 V=M*256+N
770 V1=V
780 GOSUB 3580
790 V$=HEX$
800 VA=V
810 GOSUB 3130
```

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Disassembler . . . from p.63

```
2380 GOSUB 3580
2390 VV$(3)=HEX$
2400 OPE$="DATA >"&HEX$
2410 RETURN
2420 REM  FORMAT VII
2430 RESTORE 2470
2440 GOSUB 3540
2450 OPER$=OP$
2460 GOTO 940
2470 DATA 992,LREX,969,SKOF,928,SKO
     N,896,RTWP,864,RSET,832,IDLE
2480 REM  FORMAT VIII
2490 RESTORE 2780
2500 GOSUB 3540
2510 R$=SEG$(BIN$,13,4)
2520 GOSUB 3070
2530 D$="R"&STR$(R)
2540 LOC=LOC+2
2550 L=L+1
2560 V1=LOC
2570 GOSUB 3580
2580 LO$(L)=HEX$
2590 GOSUB 4470
2600 M1=MX
2610 N1=NX
2620 V1=256*M1+N1
2630 GOSUB 3580
2640 VV$(L)=HEX$
2650 S$=">"&HEX$
2660 IF OP$="LIMI" THEN 2720
2670 IF OP$="LWPI" THEN 2720
2680 IF OP$="STST" THEN 2740
2690 IF OP$="STWP" THEN 2740
2700 OPER$=OP$&" "&D$&","&S$
2710 GOTO 940
2720 OPER$=OP$&" "&S$
2730 GOTO 940
2740 LOC=LOC-2
2750 L=L-1
2760 OPER$=OP$&" "&D$
2770 GOTO 940
2780 DATA 768,LIMI,736,LWPI,704,STS
     T,672,STWP,640,CI,608,ORI,576,
     ANDI,544,AI,512,LI
2790 REM  FORMAT IX
2800 RESTORE 2950
2810 GOSUB 3540
2820 R$=SEG$(BIN$,13,4)
2830 T$=SEG$(BIN$,11,2)
2840 GOSUB 3070
2850 GOSUB 3280
2860 S$=R$
2870 R$=SEG$(BIN$,7,4)
2880 GOSUB 3070
2890 IF OP$<>"XOP" THEN 2920
2900 D$=STR$(R)
2910 GOTO 2930
2920 D$="R"&STR$(R)
2930 OPER$=OP$&" "&S$&","&D$
2940 GOTO 940
2950 DATA 15360,DIV,14336,MPY,11264
     ,XOP
2960 REM  CONVERT TO DECIMAL
2970 DEC=0
2980 FOR X=3 TO 15 STEP 4
2990 TEMP2$=SEG$(TEMP$,(X+1)/4,1)
3000 IF ASC(TEMP2$)>57 THEN 3050
3010 TN=ASC(TEMP2$)-48
3020 DEC=DEC+TN*S(X)
3030 NEXT X
3040 RETURN
3050 TN=ASC(TEMP2$)-55
3060 GOTO 3020
3070 REM  GET REGISTER #
3080 R=0
3090 FOR X=12 TO 15
3100 R=R+VAL(SEG$(R$,X-11,1))*S(X)
3110 NEXT X
3120 RETURN
3130 REM  CONVERT TO BINARY
3140 BIN$=""
3150 FOR X=0 TO 15
3160 BIN=INT(VA/S(X))
3170 VA=VA-(BIN*S(X))
3180 BIN$=BIN$&STR$(BIN)
3190 NEXT X
3200 RETURN
3210 REM  GET BINARY DIVISOR
3220 DATA 32768,16384,8192,4096,204
     8,1024,512,256,128,64,32,16,8,
     4,2,1
3230 RESTORE 3220
3240 FOR X=0 TO 15
3250 READ S(X)
3260 NEXT X
3270 RETURN
3280 REM  GET T-FIELD
3290 IF T$<>"00" THEN 3320
3300 R$="R"&STR$(R)
3310 RETURN
3320 IF T$<>"01" THEN 3350
3330 R$="*R"&STR$(R)
3340 RETURN
3350 IF T$<>"11" THEN 3380
3360 R$="*R"&STR$(R)&"+"
3370 RETURN
3380 LOC=LOC+2
3390 L=L+1
3400 GOSUB 4470
3410 M1=MX
3420 N1=NX
3430 V1=LOC
3440 GOSUB 3580
3450 LO$(L)=HEX$
3460 V1=M1*256+N1
3470 GOSUB 3580
3480 VV$(L)=HEX$
3490 IF R<>0 THEN 3520
3500 R$="@>"&HEX$
3510 RETURN
3520 R$="@>"&HEX$&"(R"&STR$(R)&")"
3530 RETURN
3540 REM  GET MNEMONIC OF OP CODE
3550 READ OPV,OP$
3560 IF V<OPV THEN 3550
3570 RETURN
3580 REM  CONVERT TO HEX
3590 HEX$=""
3600 FOR X=3 TO 15 STEP 4
3610 VH=INT(V1/S(X))
3620 V1=V1-VH*S(X)
3630 IF VH>9 THEN 3670
3640 HEX$=HEX$&STR$(VH)
3650 NEXT X
3660 RETURN
3670 HEX$=HEX$&CHR$(VH+55)
3680 GOTO 3650
3690 OPER$="ILLEGAL OBJECT CODE"
3700 GOTO 940
3710 REM  DISPLAY DATA
3720 FOR LOOP=A TO B STEP 18
3730 V1=LOOP
3740 GOSUB 3580
3750 L$=HEX$
3760 PRINT #F:L$;"           ";"DAT
     A ";
3770 FOR LOC=LOOP TO LOOP+16 STEP 2
3780 GOSUB 4470
3790 M=MX
3800 N=NX
3810 V1=256*M+N
3820 GOSUB 3580
3830 IF LOC=LOOP+16 THEN 3860
3840 IF LOC>=B-1 THEN 3890
3850 PRINT #F:">";HEX$;",";
3860 NEXT LOC
3870 PRINT #F:">";HEX$
3880 NEXT LOOP
3890 PRINT #F:">";HEX$
3900 GOTO 420
3910 REM  DISPLAY TEXT
3920 FOR LOOP=A TO B STEP 54
3930 V1=LOOP
3940 GOSUB 3580
3950 PRINT #F:HEX$;"              ";"T
     EXT '";
3960 FOR LOC=LOOP TO LOOP+53
3970 GOSUB 4470
3980 M=MX
3990 IF (M<127)+(M>31)=-2 THEN 4010
4000 M=63
4010 PRINT #F:CHR$(M);
4020 IF LOC=B THEN 4060
4030 NEXT LOC
4040 PRINT #F:"'"
4050 NEXT LOOP
4060 PRINT #F:"'"
4070 GOTO 420
4080 REM  DISPLAY DATA ON SCREEN
4090 FOR LOOP=A TO B STEP 6
4100 V1=LOOP
4110 GOSUB 3580
4120 L$=HEX$
4130 PRINT #F:L$;" DATA ";
4140 FOR LOC=LOOP TO LOOP+4 STEP 2
4150 GOSUB 4470
4160 M=MX
4170 N=NX
4180 V1=256*M+N
4190 GOSUB 3580
4200 IF LOC=LOOP+4 THEN 4230
4210 IF LOC>=B-1 THEN 4260
4220 PRINT #F:">";HEX$;",";
4230 NEXT LOC
4240 PRINT #F:">";HEX$
4250 NEXT LOOP
4260 PRINT #F:">";HEX$
4270 GOTO 420
4280 REM  DISPLAY TEXT ON SCREEN
4290 FOR LOOP=A TO B STEP 14
4300 V1=LOOP
4310 GOSUB 3580
4320 PRINT #F:HEX$;" TEXT '";
4330 FOR LOC=LOOP TO LOOP+13
4340 GOSUB 4470
4350 M=MX
4360 IF (M<127)+(M>31)=-2 THEN 4380
4370 M=63
4380 PRINT #F:CHR$(M);
4390 IF LOC=B THEN 4430
4400 NEXT LOC
4410 PRINT #F:"'"
4420 NEXT LOOP
4430 PRINT #F:"'"
4440 GOTO 420
4450 REM
4460 REM   PEEK ROUTINE
4470 IF LOC<32768 THEN 4500
4480 LOCX=LOC-65536
4490 GOTO 4510
4500 LOCX=LOC
4510 CALL PEEK(LOCX,MX,NX)
4520 RETURN
4530 END
```

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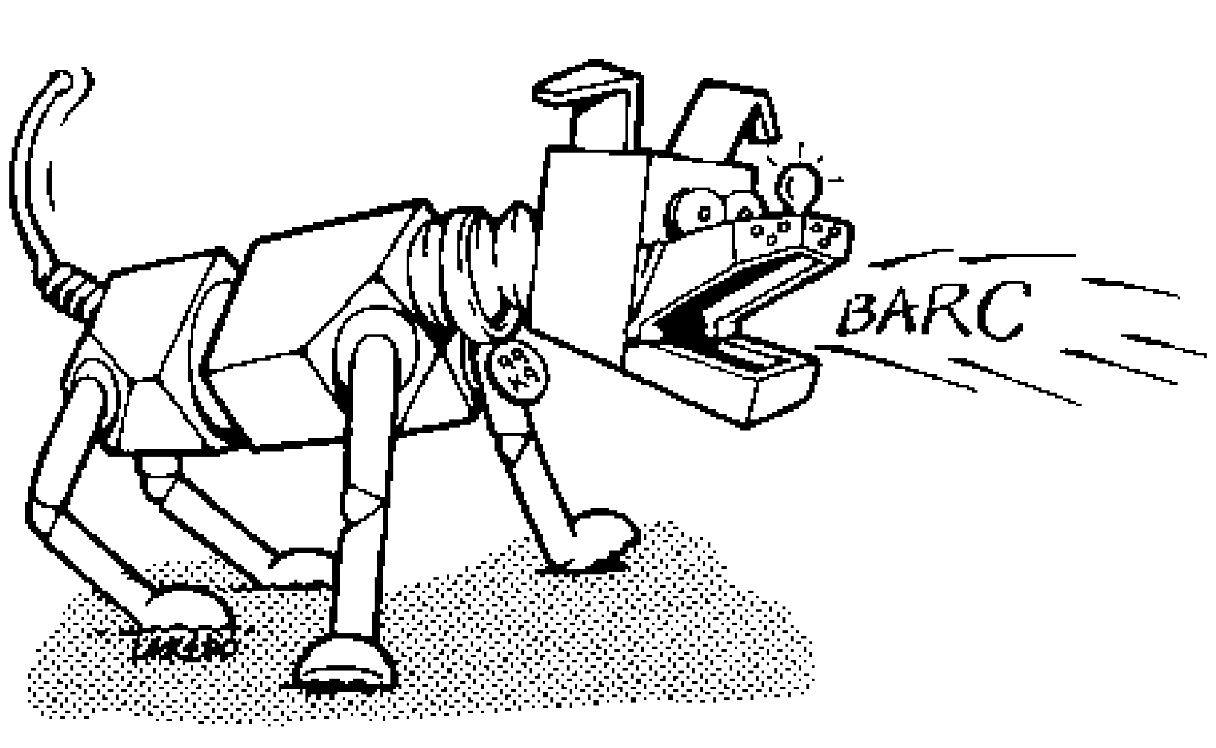
MATRIX ...from p.57

```
320 PRINT ".";TAB(23);".":".";TAB(
    23);".":".";TAB(23);".":
330 PRINT "A(N,1),A(N,2),...,A(N,N
    )":::
340 PRINT " INPUT THE MATRIX VALUE
    S":" ROW BY ROW:"::
350 FOR I=1 TO N
360 FOR J=1 TO N
370 INPUT "A("&STR$(I)&","&STR$(J)
    &") = ":A(I,J)
380 Z(I,J)=A(I,J)
390 NEXT J
400 PRINT
410 NEXT I
420 REM  INPUT MATRIX B
430 PRINT ::"NOW INPUT ELEMENTS OF
     B:"::
440 FOR I=1 TO N
450 INPUT "B("&STR$(I)&") = ":B(I)
460 NEXT I
470 CALL CLEAR
480 REM  INVERT MATRIX A
490 FOR L=1 TO N
500 PRINT "          M U N C H   "::
510 IF Z(L,L)<>0 THEN 530
520 GOSUB 780
530 Z(L,L)=1/Z(L,L)
540 FOR K=1 TO N
550 IF (K-L)=0 THEN 610
560 Z(K,L)=Z(K,L)*Z(L,L)
570 FOR M=1 TO N
580 IF (M-L)=0 THEN 600
590 Z(K,M)=Z(K,M)-Z(K,L)*Z(L,M)
600 NEXT M
610 NEXT K
620 FOR M=1 TO N
630 IF (M-L)=0 THEN 650
640 Z(L,M)=-Z(L,L)*Z(L,M)
650 NEXT M
660 NEXT L
670 PRINT ::"SOLUTION VALUES ARE:"
    :
680 FOR I=1 TO N
690 X(I)=0
700 FOR J=1 TO N
710 X(I)=X(I)+Z(I,J)*B(J)
720 NEXT J
730 PRINT :"  X("&STR$(I)&") = ";X
    (I)
740 NEXT I
750 PRINT ::
760 STOP
770 REM  SUB TO SWITCH ROWS
780 FOR LL=L+1 TO N
790 IF Z(LL,L)=0 THEN 890
800 FOR M=1 TO N
810 DZ=Z(L,M)
820 Z(L,M)=Z(LL,M)
830 Z(LL,M)=DZ
840 NEXT M
850 DB=B(L)
860 B(L)=B(LL)
870 B(LL)=DB
880 RETURN
890 NEXT LL
900 PRINT ::"SORRY, A DETERMINANT=
    0."
910 PRINT :"THERE IS NO UNIQUE SOL
    UTION."::
920 END
```



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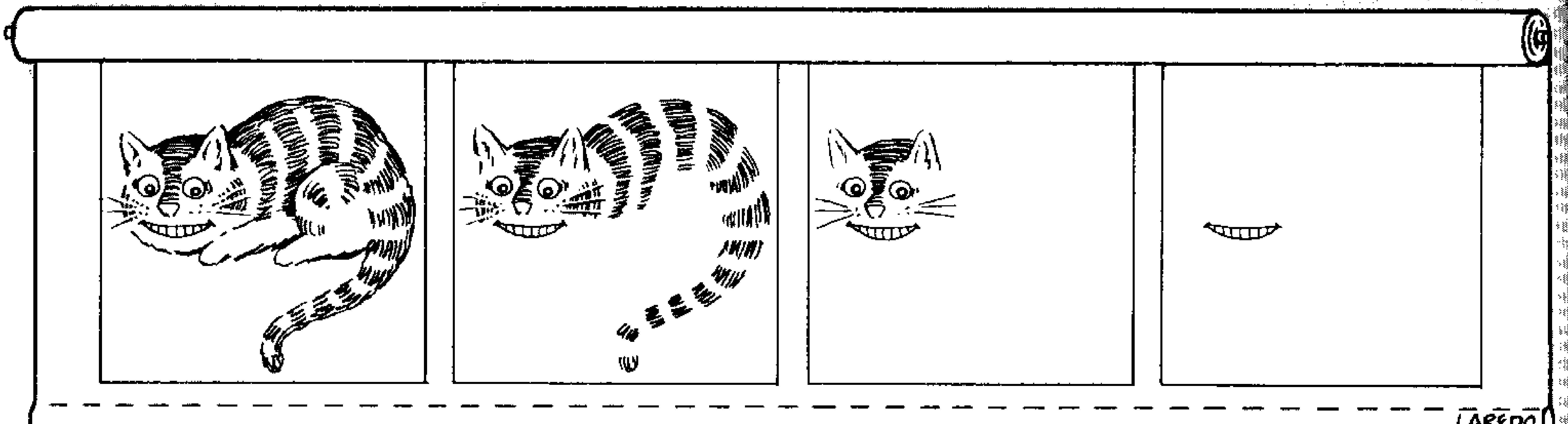

PULLING THE SHADE ON SPRITES

By W. K. Balthrop

99'er Staff

The word *sprite* may bring to mind visions of elves, pixies, and other fairy tale characters, but it is also a computer term to describe graphics characters (or shapes) in a video display. The TI-99/4A can display and move up to 32 sprites in TMS9900 Assembly Language, LOGO, Extended BASIC and other TI languages. The computer only needs to know the X and Y velocity to move any sprite automatically.

When viewing sprites on the TI-99/4A, you may notice a peculiar phenomenon: Occasionally all or part of a sprite will suddenly blank out and then reappear. Don't worry, there's nothing wrong with the computer. The TMS9918A video processor is configured so that no more than four sprites can appear on the same horizontal line. When they do, the four "lowest numbered" sprites appear solid and the rest are blanked out. For example, if I place nine sprites on the same line, numbering them from left to right as sprites 1 through 9, only sprites 1 through 4 will be visible on the screen. All nine sprites are still there; some are simply invisible. To demonstrate this phenomenon, I have provided a short program. Enter the following lines:

```
100 REM ********************
110 REM * SPRITES IN A ROW *
120 REM ********************
130 REM BY W.K. BALTHROP
140 REM 99'ER VERSION 2.5.1XB
150 REM
160 REM
170 CALL CLEAR :: CALL SCREEN(2)::
     CALL MAGNIFY(2)
180 FOR X=1 TO 9 :: CALL SPRITE(#X
    ,48+X,16,92,20+(X*20)):: NEXT
    X
190 CALL KEY(0,K,S):: IF S=0 THEN
    190
200 CALL MOTION(#3,-1,0):: FOR TD=
    1 TO 300 :: NEXT TD
210 CALL KEY(0,K,S):: IF S=0 THEN
    210
220 FOR X=6 TO 9 :: CALL MOTION(#X
    ,-1,0):: NEXT X
230 CALL KEY(0,K,S):: IF S=0 THEN
    230
```

Now type RUN and press ENTER. Line 170 will blank the screen, turn it black, and set the sprite magnity mode to 2 (for double-sized sprites, to make the effect easier to see). Line 180 places all nine sprites on the same line. You will see only sprites 1 through 4 on the screen. Now press any key. Sprite 3 will be given an upward motion in Line 200. The rest of Line 200 is a time delay loop so that the program will not advance too soon.

Sprite 5 will start to appear to the right of sprite 4, proving that it was there all the time. Now that sprite 3 is no longer on the same line, the four lowest numbered sprites (numbers 1, 2, 4 and 5) are visible. Sprite numbers 6, 7, 8, and 9 are still on the screen, even though you can't see them. To bring them into view, press another key. Line 220 will then give sprites 6, 7, 8 and 9 an upward motion. As they rise above the lower four sprites, sprites 6, 7, 8, and 9 come into view. The whole sprite doesn't just appear at once. Each row of the sprite's dots becomes visible as it rises above the lower four sprites. Line 230 tests the keyboard again, so that you can advance to the second half of the program (which you have yet to key in).

Invisible (and slowly reappearing) sprites can be a real asset for creating special effects. You can use them to simulate the opening of a window blind or the gradual appearance of a Cheshire cat in a tree. You can hide a sprite without having to place it behind another and bring it into view slowly. You can make a sprite appear from behind a fence without making the fence out of sprites. The design possiblities are unlimited. For an example of how the disappearing sprites can be used, add these lines to the program:

```
240 CALL DELSPRITE(ALL)
250 CALL SCREEN(6)
260 CALL CHAR(48,"FFFFFFFFFFFFFFFF
    "):: CALL CHAR(49,"FF"):: CALL
     CHAR(50,"C0A09088848281FF")
270 CALL CHAR(51,"3C7EFFFFFFFF7E3C
    ")
280 DATA "0000000000","0000000000
    012","0000000000 000","0000000
    0000000"," 3          3  3"
290 FOR X=1 TO 5 :: READ D$ :: DIS
    PLAY AT(X+10,5):D$ :: NEXT X
300 FOR X=1 TO 4 :: CALL SPRITE(#X
    ,32,1,88,250):: NEXT X
310 CALL SPRITE(#10,57,16,88,56,#1
    1,57,16,88,72,#12,101,16,88,88
    ,#13,114,16,88,104)
320 CALL KEY(0,K,S):: IF S=0 THEN
    320
330 CALL MOTION(#1,-1,0,#2,-1,0,#3
    ,-1,0,#4,-1,0)
340 FOR TD=110 TO 3000 STEP 50 ::
    CALL SOUND(-1000,TD,0):: NEXT
    TD
350 COLOR=INT(RND*13)+4
360 FOR X=10 TO 13 :: CALL COLOR(#
    X,COLOR):: FOR TD=1 TO 100 ::
    NEXT TD :: NEXT X
370 CALL KEY(0,K,S):: IF S=0 THEN
    350
```

Line 240 gets rid of the sprites we just used so that we can start anew. Line 250 then changes the screen color to blue. Lines 260 and 270 create the graphics characters needed for the display. Line 280 contains the graphics pattern in a DATA statement. Line 290 displays the graphics in a FOR NEXT loop by reading the data statement in Line 280 and using DISPLAY AT to place the graphics at the desired positions. Line 300 places four invisible sprites at the edge of the screen. These will blank out the sprites we will be viewing. Line 310 now displays the sprites of interest. Line 320 will wait for you to press a key, and then advance to Line 330. In Line 330 the four invisible sprites that were placed to the side of the screen are given an upward motion. As they move up, the mysterious identity of our graphics will be revealed. Line 340 simply adds some interesting sound effects. Lines 350 through 370 will continue changing the color of the sprites until a key is pressed.

So, if your sprites suddenly start disappearing on you, no one is pulling the shade over your eyes. You are merely seeing a *feature* of Extended BASIC that you can use to *enhance* programming on the TI-99/4A.

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CONVERSATIONAL SPANISH LEARNING SOFTWARE

A new software package for people who want to learn conversational Spanish has been developed by Texas Instruments under license with Westinghouse Learning Corporation.

The package, Key to Spanish, consists of a three-ring binder containing four Solid State Software cartridges, four audio cassettes, and an instruction manual. The software is designed primarily to teach vacation travelers or businessmen the Central and South American dialect of Spanish.

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An introductory lesson and six subsequent lessons and word games are contained in the cartridges. The audio cassettes, which are controlled by the cartridges, help beginning speakers learn to pronounce Spanish in conjunction with the lesson plans. The system concentrates on useful phrases and words that are most common in day-to-day Spanish usage. Because the system is designed to let students learn at their own pace, they can disconnect the cassette player from the computer and operate it manually to control the pace.

Users will need a TI-99/4A Home Computer and a cassette player, such as the new Texas Instruments Program Recorder. Suggested retail price for the software album is $149.95; availability is second quarter 1983.

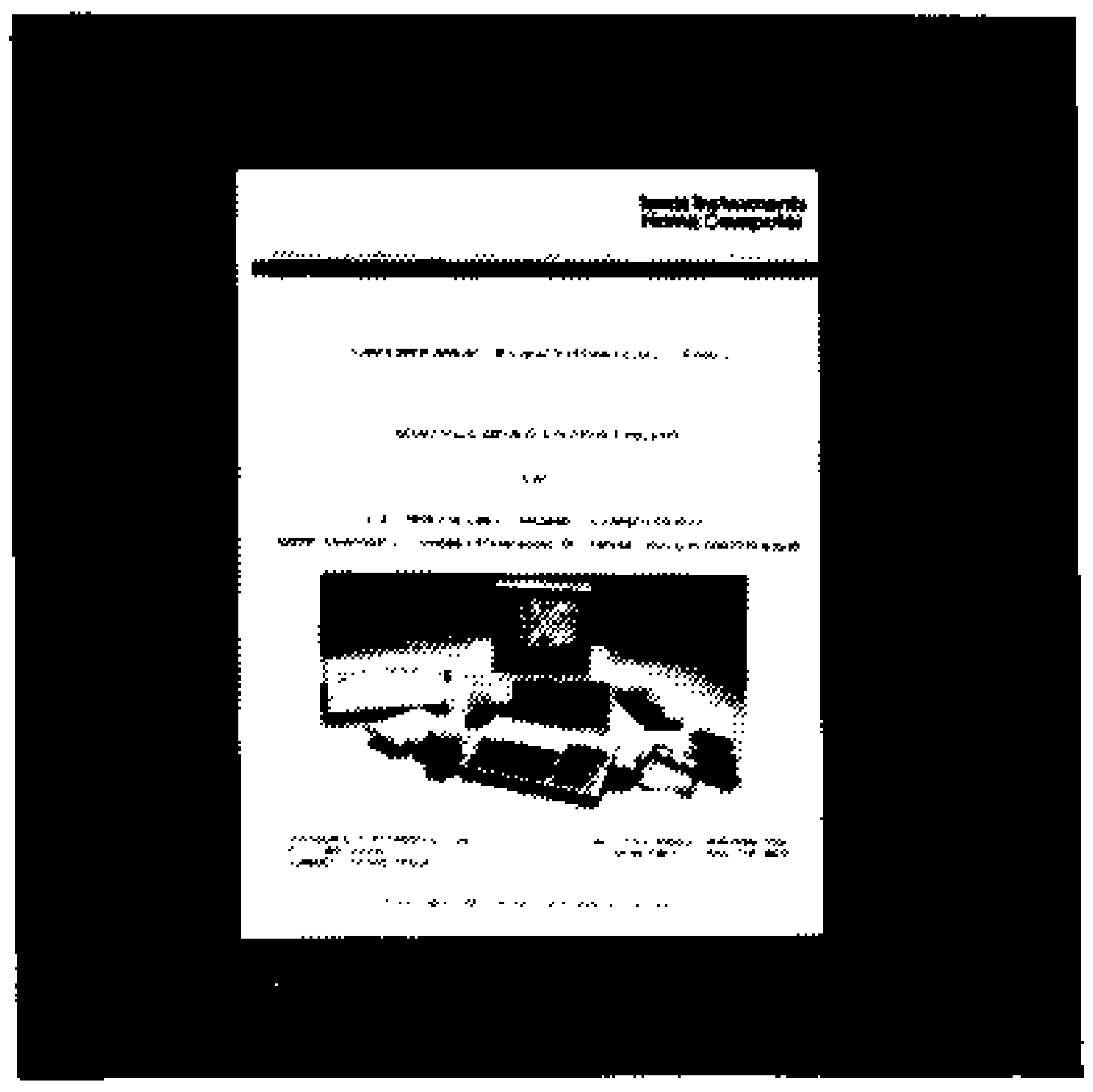
SCHEDULE PROGRAM NOW AVAILABLE

Dynamic Data and Devices has recently announced availability of *The Scheduler*, a program designed for engineers and schedulers, using the critical path method (CPM).

Users enter activities by name, duration and mode numbers. Other inputs are client's name and address, project name, location, and start date. The selectable printouts are a DATA TABLE and a BAR-GRAPH. These show both early and late start and finish dates as well as float time. The BAR-GRAPH features a unique bar print for activity duration.

Costs can be summarized for months, quarters, or other time periods, permitting forecast of when funding will be required throughout the project. The program has a built-in calendar with automatic correction for leap years. The one year bar-graph requires an 80 column printer; two year print requires 132 column (compressed print mode is selectable). Also required is Extended BASIC, 32K memory expansion, and at least one disk drive. Available on disk only, the program comes complete with instructions for $38.00. For more information, contact Dynamic Data and Devices, P.O. Box 912, Stafford, TX 77477.

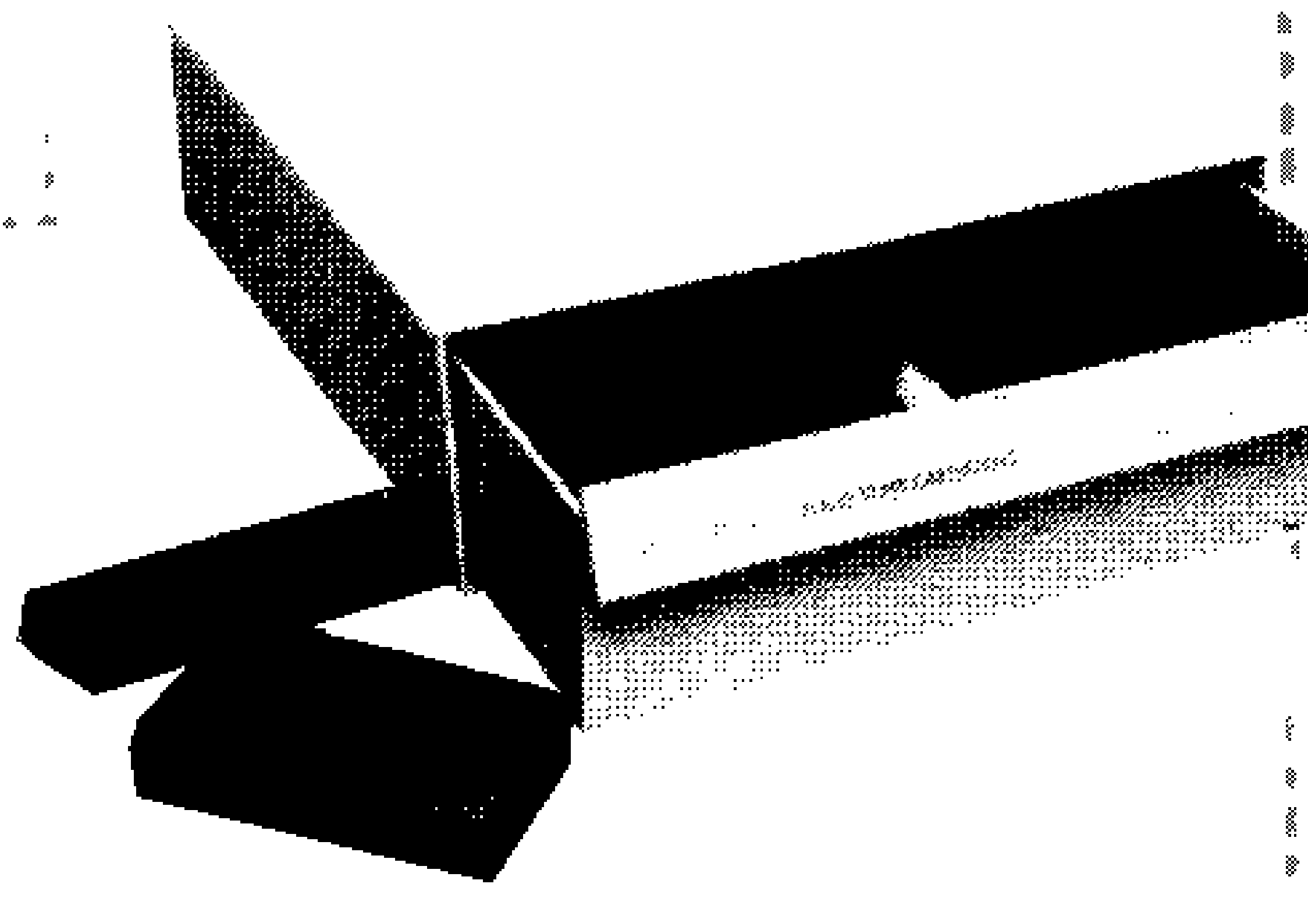
ENCYCLOPEDIA/CATALOG FOR 99/4A



Unisource Electronics, Inc. has announced a new Encyclopedia/Catalog of TI-99/4A Home Computer software, peripherals, and accessories. Featuring descriptions of TI and third-party products, the publication is available for a cost of $3 plus $1.50 postage. To order, contact Unisource Electronics at Box 64240, Lubbock, TX 79464.

PLASTIC STORAGE CABINET FOR CARTRIDGES & CASSETTES

A storage cabinet for TI-99/4A cartridge or cassette software packages has been announced by Texas Instruments. The new cabinet holds 12 cartridges or cassettes in two sliding drawers and is designed to be stackable. It will be available in the first quarter of 1983 for a suggested retail price of $14.95.



NEW BUSINESS SOFTWARE FOR HOME COMPUTER

The TI-Count Business Series of six software packages implementing basic accounting functions for persons who conduct business at home will be available from Texas Instruments for the TI-99/4A Home Computer.

The TI-Count Series, developed for Texas Instruments by Pike Creek Computer Co., Inc., comprises six diskette-based packages written in TI Extended BASIC language. The programs include: General Ledger, Accounts Payable, Accounts Receivable, Payroll, Inventory, and Mail List. The first four of these packages are integrated. All packages will have a suggested retail price of $99.95 each and will be available in the second quarter of 1983.

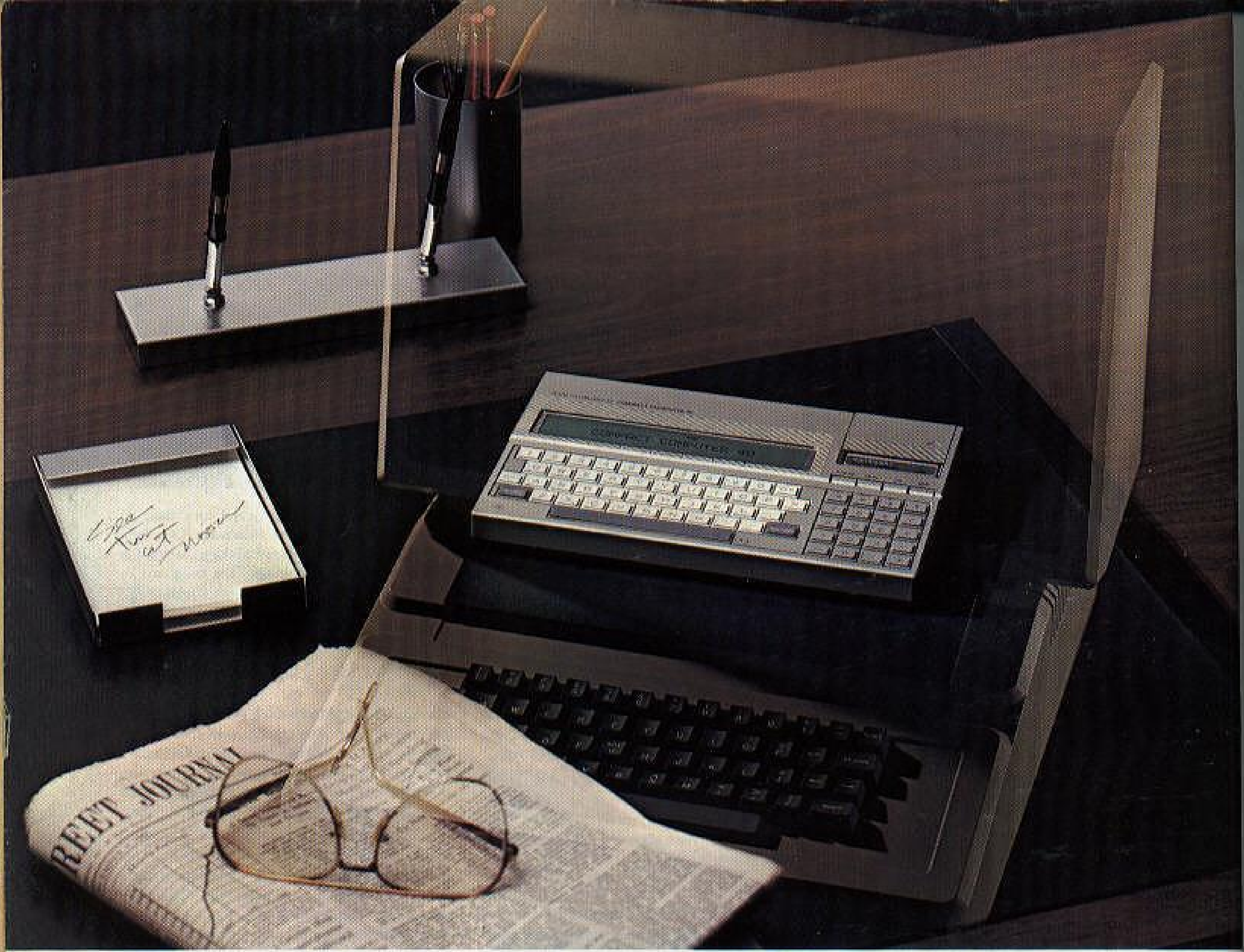
Users will need a TI-99/4A Console, an Extended BASIC Cartridge, a Peripheral Expansion System, a Disk Memory Drive, a Disk Controller Card, RS232 Card, and a printer. For optimum utilization, an additional Disk Memory Drive and a Memory Expansion Card are recommended.

A SOUND DIGITIZING EXPERIMENT

A new software product from Data Force Inc., *Sound Digitizer Experiment I*, allows the Home Computer to "listen" to sounds through the cassette recorder and "digitize" them into either the TI Mini Memory or the 32K Memory Expansion. Approximately six words can be stored in Mini Memory to be "repeated" back through the speaker.

These *listen* and *repeat* functions are accessed from programs written in TI BASIC. The TI Speech Synthesizer isn't required for this program to operate.

The minimum requirements to use the software are TI-99 4(A), TI Mini Memory cartridge, and a cassette recorder. The program, written in assembly, is available on tape for $19.95 from Data Force Inc., 10 South 312 Hampshire Lane East, Hinsdale, IL 60521.



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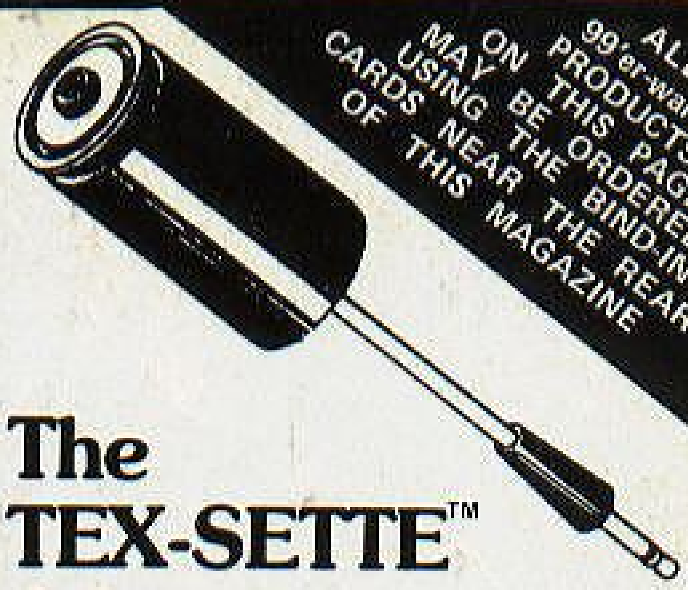

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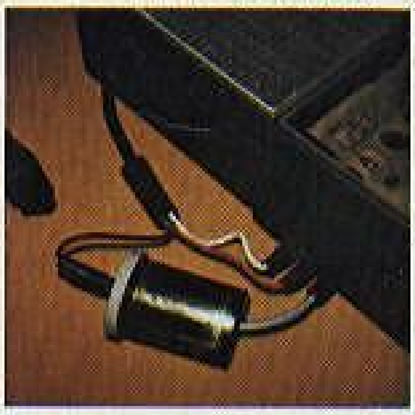

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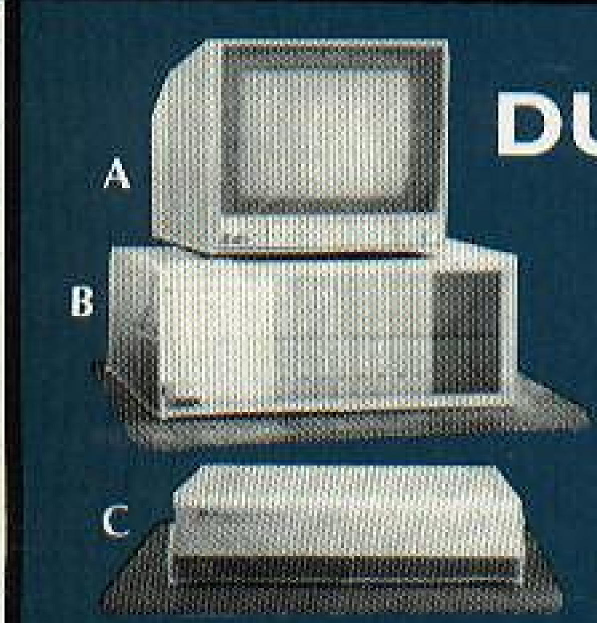

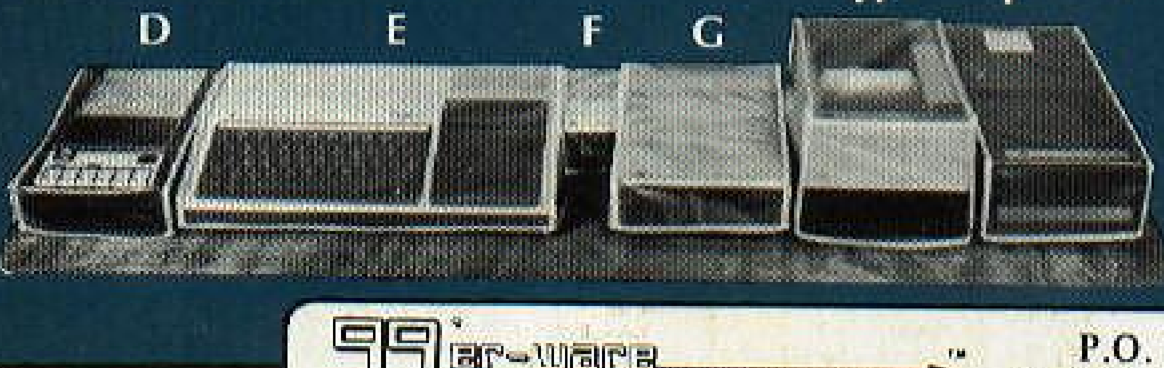

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